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Contents

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

What General Electric People Are Saying...

G. C. HOUSTON

Mr. Houston is Manager—Manufacturing Training Services Section, Manufacturing Personnel Development Services Department.

" . . . Leadership ability is not developed by attending lectures or by reading, even though such activities may be helpful in stimulating thinking and developing a higher degree of understanding. We believe, without qualification, that the only sound way to acquire and develop these abilities is through the process of learning by doing. Consequently, any well-conceived leadership development program is built around these principles . . .

Provide opportunities in the work situation to practice doing those things required of men in positions of leadership responsibility.

Associate with proved leaders.

Adequately evaluate performance and give sound guidance and counseling along the way.

Each of the individual's assignments in his work situation should be supervised by a man who has already proved his leadership ability, who is genuinely interested in developing others, and who is familiar with the objectives of the assignment in relation to the needs of the candidate. The assignment should be planned to provide experience which will not only increase the candidate's know-how, but which will also provide an opportunity to strengthen his weak points or further develop his specific abilities.

G. E. Review

P. R. HEINMILLER

Mr. Heinmiller is Managing Editor of the General Electric Review.

" . . . There is more writing in industry than turning out technical reports. There are letters and memorandums, reports and articles to associates in your field of engineering, and what is most difficult of all, presentations to management. I say 'most difficult of all' because you must get your ideas across to non-engineers, and you cannot take refuge in technical jargon.

When writing signed articles for technical publications, you must: know your audience, write so your audience can understand you, and keep everything in a logical sequence. Be complete and concise, use active verbs, mix short sentences with long ones to give a change of pace, and avoid clichés. Start with an outline and then fill it in.

All other things being equal, the engineer who is articulate, who is able to express himself orally and in writing in an understandable manner, will gain more prominence than one who cannot. (I prefer the word "prominence" to "success," because the latter has conflicting definitions and often carries a high price tag.)

at Case Institute of Technology, Cleveland

H. M. ROZENDAAL

Dr. Rozendaal is Manager—Biological Studies Section, General Electric Research Laboratory.

" . . . Engineers and physicists have contributed much to technics in medicine and biology. Many of their efforts have been in the field of medical physics or biophysics. They have led to the discovery or development of apparatus, such as electrocardiographs, x-ray machines, diathermy equipment, electron microscopes, analytical apparatus using ultraviolet and infrared light, to mention only a few. Drs. Whitney and Coolidge in our Laboratory have been pioneers in this field and their contributions are known to every physician.

And now atomic energy has seriously affected medical diagnosis, medical therapy and biological research. New apparatus is being introduced to medical personnel. New devices for more accurate measurements and localization of radioactive isotopes in the body are needed. In these and allied fields, the engineer, the medical man and the biologist have many interests in common. We must encourage these people to get together to explore problems of mutual interest. Such an approach will be of interest to the scientists but, much more important, it may result in developments of great benefit to our patients.

at the Institute of Radio Engineers, Syracuse, N. Y.

You can put your confidence in—

GENERAL ELECTRIC

Canadian Men of Science

William J. Noble and K. D. C. Haley
Acadia University, Wolfville, Nova Scotia

FEW AMERICANS are conscious that Canada provides any significant contribution to North American science. On the other hand, it has always been a source of concern to Canadians that their best brains emigrated to the United States. Actually, the whole question of the place of Canadian science in North America stands in need of appraisal. If one considers only the field of higher education, little evidence has been produced to show that Canadian universities occupy a significant place in North American scientific activity. In this paper, which is a study of that group of distinguished men of science who have received their prebaccalaureate university training in Canada, the contribution of these universities will be set forth quantitatively. The paper also describes the geographic distribution of Canadian-trained scientists, where they obtain their graduate training, and their ultimate occupations.

Many studies of science and scientists in the United States have been based upon the different editions of the carefully compiled *American Men of Science*. (This work, which might well be called "North American Men of Science," includes the names of scientists in Canada selected on the same broad basis as those in the United States.) In particular, the study made under the direction of a Committee of the Faculty of Wesleyan University and published as *Origins of American Scientists*, by Knapp and Goodrich (hereinafter called the Wesleyan Report), was based on the seventh edition of *American Men of Science* (1944). Although the eighth edition (1949) is now available, the former was preferred as a basis of comparison.

The preliminary work for the Wesleyan Report involved the sifting of the 34,000 names in the seventh edition of *American Men of Science* to include only those receiving their first degrees in the United States. One important segment so excluded was made up of those receiving their first degrees in Canada. The abstracted pertinent information on these Canadian-trained American men of science (1669 out of 34,000) has provided the basic data for the present study. Because of the small size of this group, it was not deemed expedient (except where indicated) to follow the Wesleyan procedure of limiting the study to those scientists who had Ph.D.'s or were starred as outstanding.

The criterion for selection, then, was that the first degree, representing in general not more than four years of college work, should be taken at a Canadian university. The only possible error in selection was in missing a Canadian-trained scientist in the search. An error of this nature was avoided, in so far as was humanly possible, by the direct procedure of reading every individual biography in *American Men of Science* until the origin of the first degree was ascertained. It was obviously impossible to abstract the information on a scientist whose first recorded degree was not at a Canadian university.

The information abstracted for the study included name and sex, field of science, place and date of birth, university and date of first degree, university and date of highest degree, type of occupation, and location as of 1944. In view of the care taken in compiling *American Men of Science*, it is felt that this gives a comprehensive list of distinguished Canadian-trained scientists based on a significant contribution to new knowledge in some field of science by each individual involved. It is in contrast to various other lists of Canadian scientists based not upon a contribution to knowledge but upon such criteria as scholarships and graduate degrees.

The Origins of Canadian-Trained Scientists. The basic population of the 1669 Canadian-trained scientists is first classified according to university of origin, field of science, and decade of first degree (Table 1). By university of origin is meant that Canadian university where the scientist obtained his first degree. All scientists were classified under the seven fields of astronomy, biology, chemistry, geology, mathematics, physics, and psychology. In most cases the biography furnished a clear-cut statement of the individual's field of science. The many medical scientists were assigned to biology, and the few engineers, with the exception of chemical engineers, to physics. In the case of borderline fields, such as astrophysics and biochemistry, the individual biography was read for research interests and a decision made; biochemistry gave the most trouble and some errors in the choice of major emphasis were undoubtedly made. The date of the first degree presented little difficulty. In the rare event of its not being given, a probable date was assigned on the basis of date of birth, higher degrees, and so forth.

The gross figures of Table 1 show the contribution of Canadian undergraduate training to North American science. The total production of individual universities can be seen. The areas of strength and weakness in particular sciences and universities are exhibited through five decades. The decade 1920–29 is probably the most comprehensive. That is, scientists graduating in this decade have had time to produce significant work. The earlier decades are truncated by death and

TABLE 1. Numbers of scientists by universities of origin and fields and decades.

	DK	Ac	FX	NB	MA	MG	B	L	Mo	To	WO	Q	O	MM	Ma	S	Ab	BC	*al.*
Astronomy																			
–99	—	—	—	—	—	—	—	—	—	1	—	1	—	—	—	—	—	—	—
00–09	—	—	—	—	—	—	—	—	—	4	—	1	—	—	—	—	—	—	—
10–19	—	—	—	—	—	—	—	—	—	3	—	—	—	—	—	—	—	—	—
20–29	—	—	—	—	—	2	—	—	—	4	1	—	—	—	1	—	—	2	—
30–39	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—
Biology																			
–99	—	—	—	—	1	11	—	—	1	26	—	3	—	1	1	—	—	—	5
00–09	2	1	2	—	2	18	—	2	—	30	2	4	—	3	2	—	—	—	5
10–19	8	6	—	1	1	33	1	4	—	52	2	9	1	5	6	6	3	3	5
20–29	10	13	—	1	2	50	—	6	7	85	7	19	—	4	15	25	16	31	13
30–39	1	5	—	5	—	20	—	1	6	39	4	5	1	7	9	16	17	19	8
Chemistry																			
–99	1	—	—	—	—	3	—	—	—	10	—	2	1	1	—	—	—	—	—
00–09	2	2	—	2	1	6	—	—	—	8	—	3	—	4	1	—	—	—	—
10–19	2	—	—	1	1	6	2	—	1	13	—	4	1	7	1	2	3	4	1
20–29	9	4	—	1	5	17	—	3	2	21	2	18	—	3	8	20	12	29	2
30–39	8	2	2	5	10	22	2	2	—	23	8	11	—	5	9	14	12	14	1
Geology																			
–99	—	1	—	—	—	5	—	1	—	5	—	—	—	2	1	—	—	—	—
00–09	1	2	—	—	—	5	—	—	—	8	—	7	—	—	1	—	—	—	—
10–19	—	3	1	—	—	4	—	1	1	8	—	5	—	1	2	—	2	3	—
20–29	—	2	—	1	—	10	—	2	—	7	2	6	—	—	14	—	6	16	1
30–39	1	1	2	1	—	—	—	—	—	7	—	2	—	—	3	2	6	10	—
Mathematics																			
–99	—	1	1	1	1	1	—	—	—	8	—	—	—	1	—	—	—	—	—
00–09	—	2	—	2	—	—	—	—	—	4	—	3	—	2	—	—	—	—	—
10–19	—	1	1	1	1	—	—	1	—	—	—	2	—	—	—	—	1	—	—
20–29	1	6	—	—	4	2	1	1	—	6	1	1	—	—	4	3	1	3	—
30–39	1	—	—	—	—	—	—	—	—	8	3	1	—	2	—	—	1	4	—
Physics																			
–99	2	—	—	4	1	3	—	—	—	7	—	—	—	—	—	—	—	—	—
00–09	2	3	1	2	—	8	—	—	—	11	—	2	—	—	—	—	—	—	—
10–19	4	3	—	1	1	4	—	—	—	11	—	4	—	3	—	3	1	—	2
20–29	6	3	1	2	—	6	—	—	—	14	4	8	—	2	4	6	4	11	1
30–39	1	—	—	1	2	7	—	—	—	7	—	3	—	3	1	5	3	10	—
Psychology																			
–99	—	1	—	—	—	—	—	—	—	4	—	—	—	1	—	—	—	—	—
00–09	2	—	—	—	—	—	—	—	—	1	—	—	—	1	—	—	—	—	—
10–19	—	1	—	—	—	3	—	—	—	4	1	—	—	—	1	—	1	1	—
20–29	1	2	—	—	1	4	—	—	—	4	—	1	—	—	1	—	—	2	2
30–39	—	—	—	—	—	1	—	—	1	6	—	2	—	—	—	—	1	—	—
Totals	65	65	11	32	34	251	6	24	19	451	37	127	4	58	85	102	90	162	46

Symbols represent universities: DK, Dalhousie-Kings; Ac, Acadia; FX, St. Francis Xavier; NB, New Brunswick; MA, Mount Allison; MG, McGill; B, Bishop's; L, Laval; Mo, Montreal; To, Toronto; WO, Western Ontario; Q, Queens; O, Ottawa; MM, McMaster; Ma, Manitoba; S, Saskatchewan; Ab, Alberta; BC, British Columbia; *al.*, others.

a tapering off of scientific activity. The decade 1930–39 is inadequately represented, as later editions of *American Men of Science* should show, since many graduates in those years had yet to gain recognition.

Table 2 is a condensation of Table 1 and shows the number of Canadian men of science classified according to subject and decade. The figures in the right-hand column under each decade gave the percentages of scientists produced in particular fields during the decade in question. For example, 46 percent of the

TABLE 2. Numbers and percentages of scientists by fields and decades.

	–99		00–09		10–19		20–29		30–39		Totals	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Astronomy	2	2	5	3	3	1	10	1.5	2	0.5	22	1.3
Biology	49	41	73	42	146	51	304	46	163	39	735	44
Chemistry	18	15	29	16	49	17	156	24	150	35	402	24
Geology	15	12	24	14	31	11	67	10	35	8	172	10
Mathematics	14	12	13	7	8	3	34	5	20	5	89	5
Physics	17	14	29	16	37	13	72	11	43	10	198	12
Psychology	6	5	4	2	12	4	18	3	11	2.5	51	3
Totals	121		177		286		661		424		1669	

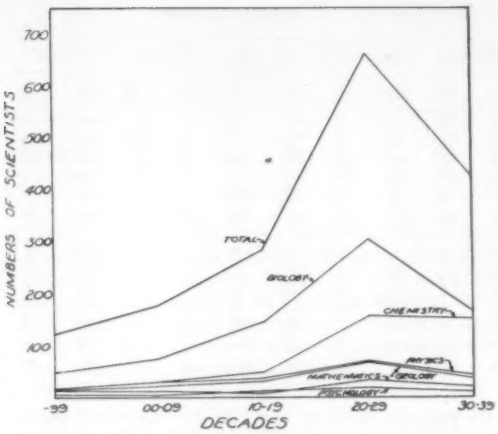

FIG. 1. Gross numbers of scientists in different fields according to decades of bachelor's degrees.

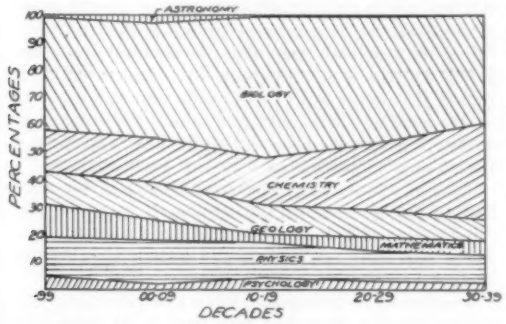

FIG. 2. Percentages of scientists in different fields according to decades of bachelor's degrees.

scientists produced in the decade 1920–29 were biologists. The table is represented in graphical form in Figs. 1 and 2. Table 2 and Figs. 1 and 2 are counterparts of those for the United States universities in the Wesleyan Report. The results are strikingly similar. Both in Canada and the United States, chemistry is growing percentage-wise in the later decades at the expense of all other fields. In Canada, the field of biology plays a much more dominant role than in the United States, where it is, in fact, slightly overshadowed by chemistry. In all other fields, the similarity between Canada and the United States is so close that probably any differences noted would not be valid.

The Productivity of Canadian Universities. Totals for the different universities are not directly comparable in assessing productivities. The four western universities made a negligible contribution before the decade 1910–19, and the enrollments of all the universities have changed greatly through the decades. The widely different achievements can be compared with each other, and with the United States figures, by following the procedure of the Wesleyan Report and calculating productivity indices for a particular period, which, here as in the Wesleyan Report, covers the eleven years from 1924 to 1934, inclusive. This was a peacetime period beginning at the end of the Canadian university expansion following World War I and ending well before World War II so that the graduates of 1934 would have completed their training and made a representative showing in the 1944 edition of *American Men of Science*. The span of eleven years covers an economic cycle of boom and depression. The numbers of scientists concerned are sufficient to give statistical validity to the index.

TABLE 3. Productivity indices of Canadian universities.

University	Scientists in period	Estimated male graduates	Productivity index	North American rank
British Columbia	97	1536	63	4
Saskatchewan	61	1184	52	8
Acadia	19	503	38	21
Mount Allison	12	373	32	30
Alberta	44	1451	30	39
New Brunswick	11	461	24	63
McMaster	14	596	24	64
Queens	46	2122	22	74
Manitoba	46	2508	18	120
Dalhousie-Kings	21	1250	17	136
McGill	59	3653	16	150
Western Ontario	17	1179	14	179
Bishop's	3	258	12	224
Toronto	99	8774	11.3	231
St. Francis Xavier	3	267	11	238
Laval	9	3620	2.5	434
Montreal	5	5160	1.0	460

TABLE 4. Ranks and productivity indices of North American universities.

	Name	P.I.		Name	P.I.
1.	Reed	132	26.	St. Olaf	34
2.	Calif. Inst. of Tech.	70	27.	Montana State	34
3.	Kalamazoo	66	28.	Utah State Agr.	33
4.	British Columbia	63	29.	Beloit	33
5.	Earlham	58	30.	Mount Allison	32
6.	Oberlin	56	31.	Bluffton	32
7.	Massachusetts State	56	32.	Carleton	32
8.	Saskatchewan	52	33.	Charleston	32
9.	Hope	51	34.	Wooster	31
10.	DePauw	48	35.	Willamette	31
11.	Nebraska Wesleyan	47	36.	Brigham Young	30
12.	Iowa Wesleyan	46	37.	Swarthmore	30
13.	Antioch	45	38.	Southwestern	30
14.	Marietta	45	39.	Alberta	30
15.	Colorado	44	40.	Lawrence	30
16.	Cornell (Iowa)	41	41.	Wabash	30
17.	Central	40	42.	W. Va. Wesleyan	30
18.	Chicago	40	43.	Rochester	28
19.	Haverford	39	44.	Westminister	28
20.	Clark	39	45.	Simpson	28
21.	Acadia	38	46.	Hiram	27
22.	Johns Hopkins	37	47.	Grinnell	27
23.	Emporia	37	48.	Brury	27
24.	Pomona	36	49.	Miami	26
25.	Wesleyan	34	50.	Wisconsin	26

TABLE 5. Numbers and percentages of scientists by origins and ultimate locations.

	Maritime		Quebec		Ontario		Toronto		Prairies		Brit. Col.		Others		Totals	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Maritime	35	17	7	2	5	2	11	2	6	2	5	3	—	—	69	4
Quebec	27	13	106	35	10	4	25	6	14	5	12	7	4	40	198	12
Ontario	34	16	52	17	111	42	214	47	48	17	23	14	2	20	484	29
Prairies	5	2	22	7	15	6	25	6	74	27	2	1	1	10	144	9
British Columbia	5	2	8	3	9	3	17	4	9	3	45	28	—	—	93	6
Subtotals	106	51	195	65	150	57	292	65	151	55	87	54	7	70	988	59
New England	22	11	14	5	14	5	9	2	9	3	9	6	—	—	77	5
Atlantic	41	20	41	14	40	15	53	12	39	14	22	13	—	—	236	14
South	15	7	15	5	14	5	24	5	21	8	6	4	1	10	96	6
Midwest	18	9	23	8	32	12	48	11	36	13	14	9	2	20	173	10
Pacific	4	2	8	3	8	3	19	4	19	7	22	13	—	—	80	5
Others	1	—	4	1	4	2	6	1	2	1	2	1	—	—	19	1
Subtotals	101	49	105	35	112	43	159	35	126	45	75	46	3	30	681	41

The productivity index is computed in the following way. We consider the Canadian-trained scientists abstracted from *American Men of Science* who have obtained their first degrees from a particular university during the period. Of these we consider only males who either have Ph.D.'s or are starred as being outstanding. This last number multiplied by a thousand forms the numerator of the index. For the denominator we consider the total number of male graduates of the given university over the eleven-year period. The index is thus a measure of the scientific productivity of a university undergraduate school, the number of distinguished scientists per thousand graduates. By using this ratio, all variations of size of university are eliminated, and universities may be compared directly as to how much of the brain power flowing through is channelled into productive scientific activity.

Table 3 gives the number of scientists produced in the period 1924–34, under the qualifications explained earlier, and estimated total numbers of male graduates in the same period, which were obtained from the *Annual Survey of Education in Canada* in so far as possible. As in the *Annual Survey*, the bachelor's degree was here taken to include medical, dental, and veterinary doctor's degrees. A small error comes from the presence of those who take the bachelor's degree in arts or science before proceeding to the degree in medicine. In any event, the four leading universities, British Columbia, Saskatchewan, Acadia, and Mount Allison, are in no way affected as they do not grant medical degrees. It is interesting to note that the ranking of the Canadian universities in the total group for North America is quite parallel with the general findings in the case of the United States universities. That is, the smaller liberal arts institutions are most productive, the Far West dominates the field, and Roman Catholic universities have very low productivities.

Table 4 shows the productivity indices of the fifty leading North American universities. It is, except for the inclusion of five Canadian universities, a reproduction of the table in the Wesleyan Report showing the leading United States institutions.

Geographic Distribution. For a generation, the Canadian popular press has been loud in its complaint that Canada has been exporting its best brains to the United States. Here we are provided with a concrete answer, at least in the field of science, as to whether the complaint is justified.

Table 5 shows the ultimate destination of scientists who received their initial training in the sections of

TABLE 6. Geographic distribution of scientists by fields.

	Astronomy		Biology		Chemistry		Geology		Mathematics		Physics		Psychology	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Maritime	—	—	31	4	17	4	6	3	5	6	9	5	1	2
Quebec	—	—	100	14	59	15	17	10	5	6	15	8	2	4
Ontario	15	68	204	28	113	28	70	41	17	19	50	25	15	29
Prairies	—	—	86	12	24	6	14	8	4	4	14	7	2	4
British Columbia	3	14	43	6	15	4	18	10	5	6	8	4	1	2
Subtotals	18	82	464	63	228	57	125	73	36	40	96	48	21	41
New England	—	—	22	3	17	4	7	4	11	12	15	8	5	10
Atlantic	—	—	79	11	79	20	8	5	14	16	45	23	11	22
South	1	5	47	6	18	4	8	5	7	8	10	5	5	10
Midwest	1	5	71	10	40	10	11	6	15	17	26	13	9	18
Pacific	1	5	39	5	18	4	10	6	6	7	6	3	—	—
Others	1	5	13	2	2	1	3	2	—	—	—	—	—	—
Subtotals	4	18	271	37	174	43	47	27	53	60	102	52	30	59

TABLE 7. Occupations of scientists by decades.

	–99		00–09		10–19		20–29		30–39		Totals	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Government	11	9	29	16	62	22	170	26	111	26	383	23
Industry	20	17	21	12	40	14	152	23	149	35	382	23
Teaching	90	74	127	72	184	64	340	51	163	39	904	54
Totals	121		177		286		662		423		1669	

Canada indicated. The overall percentage shows that 59 percent of the top scientists chose to remain in Canada, while 41 percent emigrated. The maritime and far western scientists tend to emigrate more than those from the central provinces. Of those who stay in Canada, the majority are found in the central provinces, nearly half in Ontario alone. Thus, we see the peculiar phenomenon that just in those areas of lowest scientific productivity is to be found the greatest amount of scientific activity. Of those emigrating to the United States, the New England states and the Atlantic seaboard states of New York, Pennsylvania, New Jersey, and Delaware take nearly half. Nearly a quarter of the emigrants go to midwestern states, due probably to the influence of the large midwestern universities. The results say nothing as to how many United States and European scientists have migrated to Canada. However, it is unlikely that Canada has gained commensurately from these sources.

Another analysis, not shown here, was to break the table down into separate decades in an effort to establish migratory trends. In each decade the percentages are very nearly the same as those for the overall picture. Thus, of scientists who graduated before 1900, 47 percent stayed in Canada, 53 percent emigrated. In successive decades 58, 65, 59, and 59 percent stayed

TABLE 8. Numbers of Ph.D.'s by universities of origin and universities of graduate study.

	DK	Ac	FX	NB	MA	MG	B	L	Mo	To	WO	Q	MM	Ma	S	Ab	BC	*al.*	Totals
Brown	1	—	—	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—	4
Cambridge	3	—	—	—	—	4	—	—	—	5	—	5	—	2	—	—	—	1	20
California	—	—	—	—	—	4	—	—	—	6	—	2	—	—	9	5	14	—	40
Cal. Tech.	—	—	—	—	—	1	—	—	—	1	—	1	—	1	1	3	7	—	15
Chicago	1	6	—	2	2	1	—	—	—	27	1	9	9	7	4	7	5	—	81
Clark	1	—	—	—	—	—	—	—	—	4	—	—	—	—	—	—	—	—	5
Columbia	—	2	—	—	3	3	—	—	—	3	2	6	2	1	1	—	2	—	25
Cornell	2	5	—	3	—	9	—	2	3	12	1	5	2	1	1	3	7	8	64
Georgia State	—	—	—	—	—	—	—	—	—	2	—	—	—	1	2	—	2	—	7
Harvard-Radcliffe	8	8	—	2	1	9	—	—	—	19	—	8	2	2	3	3	3	—	68
Johns Hopkins	1	—	2	—	—	1	—	—	—	6	—	1	1	2	—	—	2	—	16
Illinois	—	—	—	—	—	1	—	—	—	4	1	—	7	1	1	2	6	—	23
Iowa State	—	—	—	—	—	1	—	—	—	2	1	—	1	1	3	1	—	2	12
Laval	—	—	—	—	—	—	—	4	1	—	—	—	—	—	—	—	—	1	6
Leipzig	—	—	—	—	—	—	—	—	—	3	—	1	—	—	—	—	—	—	4
London	—	1	—	—	2	1	—	—	1	4	1	—	—	1	1	1	3	—	16
Manchester	—	—	—	—	—	—	—	—	—	1	—	3	—	—	—	—	—	—	4
Mass. Inst. Tech.	1	—	—	—	1	7	—	1	—	2	—	4	—	3	1	2	10	—	32
McGill	18	5	3	4	11	73	4	3	—	9	6	7	1	11	18	16	16	3	208
Michigan	—	3	—	—	—	3	—	—	—	2	2	1	—	1	1	—	2	—	15
Minnesota	—	1	—	—	1	4	—	—	—	9	—	1	—	10	15	12	3	—	56
Montreal	—	—	—	—	—	—	—	2	2	1	—	—	—	—	—	—	—	—	5
New York	—	—	—	—	—	2	—	—	—	—	—	4	—	1	—	—	—	—	7
Northwestern	—	—	—	—	—	—	—	—	—	1	1	1	—	—	—	1	1	—	5
Oxford	—	—	—	1	—	1	—	—	—	—	—	2	—	—	1	1	1	1	8
Paris	—	—	—	—	—	1	—	1	3	—	—	—	—	—	—	—	—	1	6
Pennsylvania	—	—	—	—	—	2	—	—	—	1	—	—	1	—	—	—	—	—	4
Princeton	6	1	2	1	—	7	—	—	—	5	—	6	—	2	1	3	7	—	41
Purdue	—	—	—	—	1	—	—	—	—	—	—	1	—	—	—	—	4	—	6
Rochester	—	—	—	—	—	—	—	—	—	—	—	3	—	—	2	—	—	—	5
Rutgers	—	1	—	1	—	—	—	—	—	—	—	—	—	1	—	—	2	1	6
Stanford	—	—	—	—	—	—	—	—	—	—	—	2	—	1	2	1	3	1	10
Toronto	5	4	—	4	—	7	—	—	—	156	8	9	15	10	10	5	15	4	252
Wisconsin	—	1	—	2	—	5	—	—	—	8	3	4	3	2	9	10	10	1	58
Yale	4	16	—	2	—	4	1	—	—	4	—	5	—	—	1	1	—	—	38
Others	2	1	2	3	3	7	—	2	2	14	—	2	2	4	7	5	4	3	63
Totals	53	55	9	25	28	158	5	15	12	311	27	93	46	66	94	82	129	27	1235

Symbols represent universities: DK, Dalhousie-Kings; Ac, Acadia; FX, St. Francis Xavier; NB, New Brunswick; MA, Mount Allison; MG, McGill; B, Bishop's; L, Laval; Mo, Montreal; To, Toronto; WO, Western Ontario; Q, Queens; MM, McMaster; Ma, Manitoba; S, Saskatchewan; Ab, Alberta; BC, British Columbia; *al.*, others.

and 42, 35, 41, and 41 percent emigrated. Other percentages of location in each decade are also strikingly close to those in Table 5.

Table 6 shows the geographic distribution of scientists according to subject. A glance shows that Canadian scientists are spread rather evenly across the continent of North America, perhaps more sparsely in the regions of the Pacific coast and the Maritime Provinces of Canada. We can see that mathematicians, physicists, and psychologists emigrate more than scientists from the other fields. Geologists stay in Canada more than any other group. This table again points up the fact that Ontario leads as a center of Canadian scientific activity in all fields. The data, when broken down into decades to try to establish migratory trends, revealed none that was discernible. The pattern of scientific migration has been stable over the past seventy years.

Occupations of Canadian-Trained Scientists. Table 7 shows all the Canadian-trained scientists classified as in government service, in industrial research, or in teaching. Government classification presented the least difficulty. Industry was a broad classification which included such things as the private practice of medicine and research in private foundations, as well as research for industrial corporations. Teaching presented little difficulty, although in some cases where a person might be both teaching and engaged in research a rather arbitrary decision had to be made as to the major field of activity.

The last column in Table 7 shows that more Canadian scientists are teaching than are engaged in government and industry together. Comparing decades, the trend of the times is very clear. There is an increasing pull toward industry and government. It must be remembered, however, that the seventh edition of *American Men of Science* was published in 1944 and that the effect of the war has distorted the picture, particularly in the decade of the thirties. Even so, teaching remains the leading profession for top-grade scientists.

The Canadian Graduate Student. After graduation from a Canadian university, where does the future scientist carry his training further? To answer this question, we have considered only those who went on to obtain the Ph.D. degree or its equivalent. Table 8 shows that of the original 1669 Canadian men of science, 1235 went on to a doctorate. If a university turned out less than four Canadian Ph.D.'s, it was included in the "others" category. Of the 1235 Ph.D.'s, only 63 (5%) were obtained at universities other than the 35 named.

Table 8 shows that only two Canadian universities have held any significant place in the field of graduate study; 460 (37%) of the 1235 Ph.D.'s were turned out by McGill and Toronto; 79 (6%) received their doctorates in European universities. These included, in addition to those named, Aberdeen, Berlin, Edinburgh, Freiburg, Geneva, Glasgow, Heidelberg, Leeds, Lille, Liverpool, Louvain, Munich, Strasbourg, Wales, and Zürich. The largest group (57%) went to graduate schools in the United States. Of these schools, Chicago leads, with Harvard, Cornell, Wisconsin, Minnesota, Princeton, California, Yale, and Massachusetts Institute of Technology each producing over 30 Canadian Ph.D.'s listed in *American Men of Science.* These results, combined with the fact shown earlier that teaching is the preponderant profession for distinguished men of science, may shed some light on the root cause of Canada's devastating loss of 41 percent of her trained scientific personnel (Table 5). That is, lack of graduate training facilities in Canada requires Canadian scientists to go elsewhere.

Summary. Even by American standards, the far western universities of British Columbia and Saskatchewan have been outstanding producers of scientists. Next have been the small Maritime Province universities of Acadia and Mount Allison. The larger universities in Ontario and Quebec were much lower in scientific productivity, and the Roman Catholic schools lowest of all. Nearly half of the Canadian scientists have migrated to the United States, and, of those remaining in Canada, nearly half went to Ontario. Of the mathematicians, physicists, and psychologists, considerably more than half emigrated to the United States, whereas of the biologists, geologists, and chemists, considerably more than half remained in Canada. Two-thirds of Canada's future scientists go abroad for graduate training. Teaching remains the dominant profession for the top scientists, with some trend in evidence toward government and industry.

The Twelfth International Congress of Limnology, 1953

F. E. Fritsch

Cambridge, England

THE Twelfth International Congress of Limnology, the first such congress to be held in Britain, attracted nearly 300 participants, from about 35 countries. It opened on August 20 at Cambridge, England, with an address of welcome by Professor F. E. Fritsch, Chairman of the Council of the Freshwater Biological Association, followed by an address by Dr. Gunnar Alm, President of the International Association of Limnology. At this session, Naumann medals, instituted in 1939 in memory of one of the founders of the International Association, were awarded to Prof. F. Lenz (Plön) and Dr. L. Findenegg (Austria), in recognition of their distinguished services to limnology. On the next evening, Professor U. D'Ancona (Padua) delivered the first Edgardo Baldi Memorial Lecture. Speaking in English, Professor D'Ancona discussed the stability of lacustrine plankton communities, a subject on which Baldi and his collaborators had published numerous researches. A second evening lecture was given by Dr. E. Windle Taylor of the Metropolitan Water Board, London, who described the reservoirs providing the water supply of the metropolis and the means adopted to ensure absence of contamination. Saturday night, Dr. J. W. Jones (Liverpool) showed a cinematograph film of the spawning of salmon, and on the evening of the 24th, films illustrating Canadian and South African fisheries and underwater films of marine fishing gear in operation were shown.

During the scientific sessions, more than 100 papers were read, and it is only possible to refer to a sufficient number of them to indicate the range of topics discussed. Those aspects of limnology which are at present in the forefront of investigation received a wide measure of attention. Bottom sediments were considered from many different points of view. G. E. Hutchinson, in a paper that aroused wide interest, discussed new approaches to their chemistry, dealing with calcium content, carotenoid pigments, and amino acids. E. S. Deevey emphasized, from the biogeographic point of view, the importance of the study of the animal remains within the sediments.

Other speakers dealt with sediments in relation to the productivity of the overlying water. The role played by bacteria at the mud-water interface in the uptake of radiophosphorus was described by F. R. Hayes (Canada), who explained that, while sterile mud exchanges phosphorus throughout its depth, in living mud such exchange is restricted to a surface layer of one millimeter or less; the speaker suggested that artificial increase of the surface of the bottom might be as beneficial as fertilizing the water. The shape of the lake basin as a factor in productivity was also emphasized by D. S. Rawson (Canada), who referred to the inverse correlation between mean depth and standing crops of net plankton in Canadian lakes. The results of monthly estimations and analyses of collected sediment from various Swiss lakes were reported on by E. A. Thomas (Zürich), and H. Järnefelt (Helsinki) described similar data collected in southern Finland. The importance of the phytoplankton in contributing to the sediments in shallow lakes of the Congo was emphasized by H. Dammas (Belgium), and J. Symoens (Belgium) described tufa deposits formed by Chironomid larvae, associated with the blue-green alga *Phormidium incrustatum*. K. Berg (Denmark) discussed the bottom fauna of a humic lake in relation to the bottom deposits, and F. Lenz (Plön) that of the sandy shallow littoral regions of lakes in Holstein, where larvae of Tendipedidae predominate. J. H. Mundie (Windermere) reported on the distribution of Chironomid midges in a Thames reservoir.

Others approached productivity from the point of view of the plankton. W. Ohle, discussing the very rapid eutrophy of many North German lakes, attributed it to soil erosion accompanying intensive agriculture and to the fact that even purified sewage effluents still contribute materially toward mineral enrichment. The probable role of minute and partly heterotrophic green algae in maintaining in subarctic lakes, during the darkness of winter, about as copious a zooplankton as in summer, was discussed by W. Rodhe (Uppsala). G. E. Fogg (London) gave an account of the liberation of polypeptides by algae, which the speaker suggested might be an important factor in productivity. A paper by G. A. Prowse (Sudan) distinguished between production in fish and total biological productivity by the flora as a whole.

Various papers dealt more directly with plankton investigation. J. Rzóska (Sudan) gave an account of that of the White Nile, which gradually reaches a maximum during the accumulation of water in the second half of the year above the dam south of Khartum. J. F. Talling (London) discussed the light relations of the phytoplankton, W. Schmitz (Germany) reported on the occurrence of water flowers in flowing water, and M. Shilo (Israel) described the use of am-

monium sulfate in controlling the growth of the phytoflagellate *Prymnesium parvum*, which is toxic to fish. As regards zooplankton, V. Tonolli (Pallanza) considered the fate of organisms carried into rivers from the surface waters of lakes, while O. Ravera (Italy) and U. Røen (Denmark) dealt with seasonal variation in the reproductive rate of Pelagic Copepods. R. Margalef (Spain) gave an account of the effects of higher temperatures on the morphology of freshwater organisms. From the point of view of methodology, mention may be made of papers by A. A. Aleem (Egypt) on the use of triphenyltetrazolium chloride in the measurement of plankton populations, and of A. van der Werff (Netherlands) on a method of removing organic material from diatoms and other organisms with hydrogen peroxide and potassium permanganate.

Papers that discussed temperature relations and circulation in lakes attracted large audiences. C. H. Mortimer (Windermere) dealt with the influence of the earth's rotation on the internal wave pattern, while B. Dussart (France) gave an account of the effects of inflowing water and sublacustrine springs on thermal stratification and discussed the absorption of solar heat by the surface layers and its nocturnal radiation. The energy transfer between air and water was also considered by H. Charnock (England), who approached it from the meteorological standpoint. H. Neumann (Israel) described the second minimum of evaporation, which occurs during the period of greatest heating in lakes of middle latitudes. Temperature relations in lakes and other waters of Venezuela, Guatemala, and Salvador were likewise discussed in the course of contributions made by F. Gessner (Germany) and E. S. Deevey, the latter also reporting on investigations of photosynthetic productivity in one of the lakes, while K. F. Vaas described how in shallow ponds in Indonesia thermal stratification during the day gives place to an inverse stratification at night as a result of mixing.

R. S. B. Olivier (Argentina) gave an account of regional limnology in the province of Buenos Aires, L. Möller (Germany) discussed the regional distribution of concentration of dissolved substances in Western Germany, and H. E. Klotter (Germany) described a graphic method of recording the environmental factors obtaining during the period of increase of an algal population. E. Teiling (Sweden) dealt with certain stenotrophic algae that may serve as indicators of the trophic standard of a lake.

The distribution of freshwater organisms provided another major topic. S. Stankovič (Yugoslavia) discussed speciation in Lake Ohrid. The representation of species of *Gammarus* in Britain and Scandinavia respectively was reported on by H. B. Hynes (Liverpool) and S. G. Segerstråle (Finland). J. Illies (Germany) emphasized the value of Plecoptera in studies of geographical distribution owing to their restriction to definite temperature ranges and speeds of current. H. K. Mann (Britain) described how the distribution of leeches depends on the total alkalinity, the surface area of a water, and the presence or absence of a current, and A. G. Dahm (Sweden) dealt with *Dugesia tigrina*, a recent planarian immigrant into Europe.

Many papers referred to fish from one point of view or another. C. Kosswig (Turkey) discussed the marine element in the fish fauna of freshwater lakes near the Sea of Marmora. The causes of the lack of success attending the attempted introduction of Salmonidae into French waters were considered by P. Vivier and E. Hubault. J. R. Dymond described the introduction and spread of *Salmo trutta* and *Cyprinus carpio* in Canada, E. G. Calderon dealt with that of pike in Spain, while D. Hey (South Africa) gave an account of the culture of bream and other fish in a sewage effluent. Other speakers discussed factors affecting fish populations. The damage to eggs of char resulting from the winter lowering of the water level in an impounded lake was described by S. Runnström (Sweden). H. D. Slack (Glasgow) reported on factors affecting the survival of *Coregonus* eggs and E. D. Le Cren (Windermere) on those determining survival of perch after hatching.

On the plant side, A. Lundh-Almestrand (Sweden) discussed the distribution of diatoms in Scanian waters in relation to geologic structure, B. Knudsen (Windermere) that of *Tabellaria* in the Lake District, and F. Hustedt (Plön) gave an account of the influence of temperature of solfataras on the diatoms in Salvador. G. Lohammer (Sweden) discussed the introduction of foreign macrophytes.

The applied section devoted a whole day to the discussion of pollution and its effects. O. Jaag (Switzerland) and D. M. Newitt (Britain) dealt with the general aspects, F. T. K. Pentelow and J. R. H. Allan (Britain) with the effects of pollution on the distribution of fish, and R. W. Butcher (Britain) discussed the distribution of organisms characteristic of stages in recovery from pollution. T. Braarud (Norway) gave an account of pollution in the Oslo Fjord, and C. J. Rasmussen described pollution by silage-juices in Denmark. K. Wuhrmann (Switzerland) and D. W. M. Herbert (Britain) discussed the influence of various factors on the toxicity of poisons to fish, H. Jakob and M. Nisbet (France) reported on experiments on the toxicity of ammonium derivatives to algae and fish, and E. Hubault (France) considered toxicity in relation to molecular structure. A. B. Wheatland (Britain) described how in polluted estuaries the formation of sulfides is prevented by slight traces of oxygen, which he attributed to inhibition of the growth of sulfate-reducing bacteria.

Various British workers gave papers on matters concerned with sewage disposal. The correlation between the population of peritrichous ciliates and the quality of the effluent from activated sludge was discussed by S. Baines et al. H. Painter dealt with the factors affecting the growth of Fungi in percolating filters, and T. G. Tomlinson considered means of controlling their growth. The use of effluents in German

agriculture was described by E. Weise, while H. Husmann reported on recent methods of purification of effluents adopted in Germany. L. A. Allen (Britain) described a new method of estimating the numbers of faecal bacteria in a sewage effluent and commented on their rapid decrease, which cannot be accounted for by dilution.

Problems of water supply occupied another day. E. Windle Taylor and A. T. Palin (Britain) discussed chlorination. A. Guelin (France) spoke on the role of bacteriophage in self-purification, while J. Wautier (France) reported on experiments demonstrating the importance of the biologic film in sand filters in retaining *B. coli*. E. Mercier (Switzerland) described improvements in the water of an eutrophic lake resulting from artificial subsurface aeration during the summer stagnation period. A. Ruttner-Kolisko (Austria) spoke on the use of limnological methods in the investigation of potable waters.

The final session of the Congress was held at Windermere on the evening of August 30. The present officers of the International Association of Limnology having intimated their desire to be relieved of office, Professor F. E. Fritsch (Cambridge) was elected President and Dr. T. T. Macan (Windermere) General Secretary. A proposal to send greetings to the American Society for Limnology and Oceanography was adopted with acclamation.

A small party led by Professor J. E. G. Raymont, starting from Southampton, visited the rivers Avon and Test and inspected the work carried out by the University's Department of Zoology near Brockenhurst in the New Forest, prior to the commencement of the Congress. During the days spent at Cambridge visits were arranged to the National Trust's preserve at Wicken Fen, the sewage disposal works at Luton, and the Water Pollution Research Laboratory at Garston, while August 23 was devoted to a whole-day excursion to the Norfolk Broads. The journey from Cambridge to Windermere, occupying three days, was made by coach, during which several British rivers and large sewage works were inspected. One of the two days at Windermere was spent at the laboratory (Ferry House) of the Freshwater Biological Association (Director: H. G. Gilson) and at the Association's experimental hatchery and fish ponds at Waymires, while the other was devoted to tours in the Lake District. After the termination of the Congress, about 100 of the members spent four days in Scotland, proceeding as far north as Inverness and returning via Loch Ness and Fort William to Glasgow. This tour afforded opportunity of inspecting the Glasgow University Field Laboratory on Loch Lomond under the guidance of Dr. and Mrs. Slack, the Brown Trout Research Laboratory of the Scottish Home Department at Pitlochry at the invitation of the Director, Dr. K. A. Pyefinch, and the adjacent Tummel-Garry hydroelectric installations. A small group afterwards proceeded on a seven days' excursion into Ireland.

Although many participated in the work of preparation, the Congress owes much of its undoubted success to the labors of the Honorary Secretary, C. H. Gilson.

Cole Coolidge: 1897-1953

E. K. Bolton

IN preparing an obituary notice about the late Cole Coolidge, it is not possible to write in cold biographical terms. Our relationship over the twelve-year period in which he was assistant director of the Chemical Department, and indeed after he became director in July 1951, was that of close friendship as well as business association, and the feeling of personal loss in his tragic and untimely death following a relatively minor operation disposes me to write more in terms of his character and abilities than in mere terms of positions held and research developments to which he contributed.

Yet I remember well the astringent wit that he brought to bear on those who sought to praise him, and I know that his preference would be for a simple and factual recital of his career. This memorial will seek to steer a course that appraises the man with all possible objectivity.

A research man with a real talent for administration is likely to be marked at an early stage, as the blend of the researcher's temperament with the ability of the administrator is one not often found. Dr. Coolidge demonstrated an outstanding gift in this field early in his Du Pont career, and it is not surprising that after a very few years his feet were set upon the path that led, in 1926, to his appointment as a group leader and, a few months later, as assistant director of the Experimental Station.

Equally logical was the selection of Dr. Coolidge as assistant director of the Chemical Department in 1939, and his selection by the top management of the company to the directorship of the department. In this capacity he carried a big responsibility, as the Chemical Department serves the entire Du Pont Company through fundamental and long-range research in organic, physical, and inorganic chemistry, and physics. Its work is carried out in close cooperation with the research divisions of the ten manufacturing departments, for which it also undertakes long-range studies in many fields of applied research

including, for example, synthetic fibers, plastics, synthetic rubber, and agricultural chemicals.

Considering the dynamic nature of the chemical industry, the importance to a company such as Du Pont of an efficiently functioning and well-administered Chemical Department can hardly be overemphasized. In contributing to such a department, Dr. Coolidge set exacting standards for those reporting to him. They were, however, less exacting than the standards he set for himself. His work days as a matter of routine embraced all his waking hours, and even on days when the office was closed, his bulging brief case demanded time from his leisure hours for "home work."

The exacting standards he set for those under him were accompanied by three modifying attributes that made him well liked by his staff. The first was an ability to make clear exactly what he wanted done. The second was a very genuine liking, thoughtfulness, and respect for his associates. The third was an unusual degree of open-mindedness, and an intense desire to consider all sides of a question through complete frankness in discussion before making a decision.

Shortly before Dr. Coolidge became director of the Chemical Department, he became chairman of the Du Pont Company's Committee on Fellowships and Grants, the organization in charge of the company's program of aid to colleges and universities to promote the teaching of chemistry and an interest in research as a career. During his chairmanship the schedule of academic aid was considerably broadened.

It was a tragic thing, for Du Pont and for the chemical industry, that Dr. Coolidge survived for only so short a period as two years his designation as head of the Chemical Department. It was no less tragic for the community in which he lived, for he was active in welfare work. He was a director of the Wilmington General Hospital and the Family Society of New Castle County, and he served each as president for two terms. And he was, a few months before his death, appointed to the executive committee of the United Community Fund of Northern Delaware.

Dr. Coolidge was an enthusiastic week-end golfer; his schedule afforded time for no more. He played an occasional game of bridge, and was prone to spend his vacations in ocean travel.

He was born in East Hartford, Connecticut, but moved to Colorado in his boyhood. He was graduated from Boulder High School in 1915, studied for two years at the University of Colorado, and then moved to The Ohio State University, where he received the B.A., M.S., and Ph.D. degrees in 1920, 1921, and 1923, respectively. It was at this institution that he met Edith Hutcheson, who became his wife. When they met he was a laboratory assistant and she was taking a course in organic chemistry.

Cole Coolidge can ill be spared by those with whom he was associated, and their number is large. Those of us who claimed his friendship feel an aching sense of personal loss.

News and Notes

Resume of Fourth Alaska Science Conference

THE Fourth Alaska Science Conference, sponsored by the Alaska Division, AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, was held in Juneau, Alaska, Sept. 28–Oct. 3, 1953. One hundred and fifty-nine registrants from Alaska, Canada, England, and the United States, as well as many interested Juneau residents, participated in the 21 scientific sessions of agriculture, biological sciences, engineering, mining, aviaton, fisheries, forestry, geology, medicine, public health, physical sciences, social sciences, and 3 general sessions.

Speakers and their subjects for the general evening sessions were L. R. Blinks, director of Hopkins Marine Station, Pacific Grove, California: "Photosynthesis in the Ocean"; C. T. Elvey, director of the Geophysical Institute, University of Alaska, and retiring president of the Alaska Division: "Solar Energy"; Maynard Miller, University of Cambridge, England, who showed movies of the Juneau Ice Cap Project; Sir Charles Normand, meteorologist of Oxford, England: "Ozone and Upper Air Conditions"; and Raymond F. Taylor, forester-in-charge of the Alaska Forest Research Center, Juneau: "The Role of Technical Forestry in Developing an Alaskan Resource."

One of the highlights of the Conference was a symposium on Alaskan biogeography, conducted by Robert F. Scott of the biological sciences section, which culminated in a series of papers devoted to the involved and interrelated problems of plant and animal distribution facing biologists in Alaska. In both formal and informal discussions, 4 basic points were emphasized, namely, the particular significance of distributional peculiarities in the Alaskan Region; the importance of geological history in interpreting distributional data; the mutual assistance resulting from interdisciplinary discussion; and, as one biologist put it, the fact in describing many distributional oddities such terms as "rare," and "endemic" could be applied more appropriately to the collector than to the species studied.

The variety and scope of current Alaskan research were illustrated by the biological discussions; specialists in many fields of biology found themselves comparing notes with anthropologists, paleontologists, and geologists. One of the most stimulating presentations

at the session was an up-to-date review of Pleistocene geological events in Alaska, which included the latest thinking on the subject of a Bering Straits land bridge.

At the 3 sessions on fisheries, 14 reports and one round-table discussion were offered by Pacific Coast research workers in the fields of marine and freshwater fishery biology, oceanography, and fishery technology. Highlights of the reports and discussions indicated a greater need than ever for close collaboration of the fishery sciences and investigators if the conservation problems of the Alaska fisheries are to be solved.

Among the important lines of research discussed were the differential productivity of red salmon spawning grounds in the Bristol Bay, comprehensive studies of the life cycle of red salmon in the Nushagak River, quantitative measurements of salinity in an intertidal spawning area of pink salmon, migration and catch composition studies of sablefish in Alaska, relation of new techniques in oceanography to fishery biological research, and new studies of the species, distribution, and habitat problems of the freshwater sport fisheries in Alaska.

Confirmation of the Tanana Valley as the Territory's largest accessible potential agricultural area was disclosed in the agricultural sessions. Of 332,000 acres surveyed in the past 5 years, 166,000 acres are suited for tillage practices. This nearly exceeds by 3 times the 60,000 to 70,000 acres of tillable land found so far in the Matanuska-Anchorage region.

Food production in Alaska is losing ground, agreed savants discussing agricultural development in the Territory. New developments that have resulted from the joint United States Department of Agriculture–University of Alaska research program cannot be fully exploited because of slow farm development. Don Irwin, director of Alaska's Agricultural Experiment Station, pointed out that the land laws under which Alaska's farmland is distributed to private ownership are outmoded and no longer accomplish their purpose. Hugh Johnson, economist with the Experiment Station, cited a lack of venture capital as another obstacle to farm development.

The sessions of the section on medicine gave emphasis ranging from various clinical aspects of medicine to broader fields of public health. One clinical paper, "The Treatment of the Migraine Syndrome," outlined a new form of therapy with clinical results. The tuberculosis problem in Alaska, undoubtedly the greatest public health menace in the Territory, was thoroughly presented, and brought into focus the total needs that must be met in order to get the problem under control. Two papers brought out certain clinical aspects of medicine with emphasis on the native peoples. The effects of hypnotics and drugs on natives were presented in one, while in another paper eye diseases peculiar to native children were reviewed. Considerable group interest was shown in the papers of Alaska's mental health as presented from the viewpoint of a psychologist. This interest manifested itself through actions taken by the section that the Division should make recommendations for improving legislation to correct the undesirable conditions. Two other actions resulted from papers presented in this section, namely, that an intelligence center for epidemics be established in Alaska, and that prompt action be taken by territorial authorities to control the outbreaks of distemper along the Arctic coast, where there has been an epidemic outbreak of the disease.

The engineering and geology sessions reviewed many of the problems peculiar to construction in the far north, as well as discussing economic factors affecting mine development in Alaska. The physical sciences sessions brought out many important results of the auroral research currently carried on at the Geophysical Institute.

The outstanding social event of the Conference was an All-Alaska seafood banquet which featured dozens of dishes of Alaskan origin. Several geological field trips, as well as trips to commercial firms such as the Alaska Plywood Corporation, were enjoyed by a number of the conference participants.

Officers for the year 1953–54 elected at the annual meeting are: president, Hugh A. Johnson, Alaska Agricultural Experiment Station, Palmer; vice president, E. K. Day, Arctic Health Research Center, Anchorage; secretary, Troy L. Péwé, United States Geological Survey, Fairbanks. They replace C. T. Elvey, Geophysical Institute, College; Ivar Skarland, department of anthropology, University of Alaska, College; and Dorothy Jean Thompson, Geophysical Institute, College. The Fifth Alaska Science Conference is scheduled to be held in Anchorage in 1954.

DOROTHY JEAN THOMPSON
Secretary

Geophysical Institute
University of Alaska

Science News

Evidence showing that there were two waves of **Eskimo migration** from Alaska to Greenland across the wastes of the Canadian Arctic was found on Cornwallis Island, north of Hudson Bay, last summer by Henry B. Collins of the Smithsonian Institution. By digging below the level of the stone and bone artifacts of the relatively recent Thule Eskimo migration, Dr. Collins and his assistant, William L. Taylor, discovered delicately fashioned primitive tools belonging to people of the Dorset culture. The fate of these Eskimos is unknown, but a long interval evidently separated the two migrations. An exact dating of the early layer has not been made yet. The excavations were sponsored jointly by the Smithsonian and the National Museum of Canada.

Albert Einstein has revised his **generalized theory of gravitation**, which aims at a complete description of the physical universe by a single theory. In the previous version, published a year ago, Einstein out-

lined a method for choosing a particular set of equations based on their "strength;" however, he made an error in counting the number of significant, or applicable, equations. This is corrected in his latest revision.

Just as in 1905 his restricted theory of relativity pointed to the equivalence of mass and energy, a prediction that was vividly demonstrated nearly 40 years later by the discovery of nuclear fission, so has he now tried mathematically to join gravitational and electromagnetic forces; these, he believes, are also simply two different manifestations of the unified cosmic field. Development of a single theory to explain both gravitational and electromagnetic forces has been a major goal of physicists since about 1920. Mathematical difficulties have so far prevented experimental tests of the revised theory. Einstein believes, however, that the theory will eventually yield an explanation of the "atomic character of energy."

Serge A. Korff of New York University has been appointed reporter for cosmic rays on the U.S. National Committee that is developing a program for the **International Geophysical Year.** The IGY, which is to run from August, 1957, to December, 1958, will be a period of planned, concentrated investigations conducted by scientists throughout the world. Geophysical years are established every 25 years to amass data in such fields as meteorology, oceanography, terrestrial physics, and astronomy, in which international cooperation is essential.

At a recent meeting of the National Committee in Washington Dr. Korff presented a report on the suggested U.S. program of cosmic ray observations to be made during the International Geophysical Year. His recommendations, together with those to be made in other scientific fields, will be transmitted to the International Council of Scientific Unions, the agency that plans the IGY. The U.S. National Committee is a National Research Council body responsible for American contributions to IGY planning. Dr. Korff, professor of physics at NYU's College of Engineering and a vice president of the Explorers Club, has been a leader in cosmic ray research for the last 25 years. Last summer he led an Alaskan expedition that established a cosmic ray observatory atop Mt. Wrangell, a 14,006-foot dormant volcano. He has also established high-altitude stations for cosmic ray studies in the Andes.

The plaque method of growing animal viruses on single-celled layers of tissue cultures has been extended successfully to the **poliomyelitis virus** by biologists of the California Institute of Technology. The work was done by Renato Dulbecco, associate professor of biology, and Marguerite M. P. Vogt, research fellow in biology. First applying the technique to western equine encephalomyelitis virus, they then extended it to polio virus and as a consequence were able to isolate for the first time genetically pure strains of the three known types of polio virus. This makes intensive study of the development and hereditary properties of such viruses possible. The technique promises also to accelerate fundamental research in animal virology because it is highly accurate and less laborious to use than other methods.

Archaeological teams, working ahead of huge ditching machines that are completing a new 770-mile pipeline for the El Paso Natural Gas Company, have unearthed a profile of **Pueblo Indian history and culture.** Their finds have confirmed the theory that these people reached a high standard of civilization and lived in great numbers in the Southwest long before the coming of the white man. Jesse L. Nusbaum, senior archaeologist for the Park Service and consulting archaeologist for the Department of the Interior, was assigned to explore the entire route of the line. The Company hired five other archaeologists to assist him. Dr. Nusbaum was given authority to reroute the gas line around any site that could not be investigated in a reasonable length of time.

With the line almost complete and the archaeologists now in the final stages of their work, 170 sites have been unearthed. Practically every item taken from the buried ruins has served to confirm or refute some previously held theory on Pueblo civilization. All material excavated in New Mexico will go to the Laboratory of Anthropology of the Museum of New Mexico in Santa Fe. Material found in Arizona will be put in the Museum of Northern Arizona in Flagstaff.

President Eisenhower has recommended to Congress that the government spend $2,014,200,000 on scientific **research and development during the fiscal year 1955.** This is a drop of $113,000,000 from the amount estimated to be spent in the year ending June 30, 1954. For the first time, the budget included a special section on "Research and Development." A heavy crackdown on the construction of research facilities is responsible for most of the recommended cuts, with the military taking the biggest loss both in this and in the funds to conduct research. Even so, two-thirds of the government's research and development moneys, or a total of $1,350,000,000, will be spent by the Department of Defense. Another 13 percent of the proposed two billion dollars budgeted for research and development goes to the Atomic Energy Commission, which with the Navy not only has launched its first atomic submarine, but also has announced plans for launching during the coming fiscal year a second atomic submarine of different design. President Eisenhower proposed that the AEC spend on research $261,300,000 in the fiscal year 1955, a drop of more than ten million dollars from 1954.

One of the largest increases recommended for any scientific agency of the government during fiscal 1955 went to the National Bureau of Standards—$8,115,000 compared to $6,440,000 in 1954. Of this, a little over one million is for an increase in research and testing facilities. The proposed increase is in line with recommendations made last fall by a committee of sci-

entists, headed by Mervin J. Kelly of Bell Telephone Laboratories, that previous fund cuts be restored and augmented. Newest entry in the research and development field for the government is the President's Advisory Committee on Weather Control, given $100,000 for its first full year of operation. The committee, after studying the effects of cloud seeding efforts in making rain, will make recommendations on what weather control laws, if any, should be enacted by Congress.

A television camera has been trained into the eyepiece of a microscope to provide accurate and quick counts of small particles such as blood cells, bacterial cultures, or grains in photographic emulsions. To perfect the device, called a **sanguinometer,** electronic specialists at the David Sarnoff Research Center of the Radio Corporation of America, Princeton, N.J., collaborated with scientists at the Sloan-Kettering Institute in New York City. The new equipment can, for instance, make several blood counts and average them out for a true figure in the time that it takes a technician to make one count that may be as much as 20 percent off.

A condensed report by Evelyn Wagner of a **survey of science writers** has just been released by the University of Michigan. This survey was designed not to prove anything *a priori,* but rather to gather opinions on general questions pertinent to the subject. Some 100 questionnaires were mailed to science editors of newspapers, popular magazines, and technical journals, and to the editors of scientific industrial publications. Approximately half of the questionnaires were sent to each of two groups arbitrarily termed "popular writers" and "technical writers." Seventy-one questionnaires were returned, resulting in the following general conclusions:

(1) Scientists do not write well enough to communicate their work to the general public, and it should not necessarily be expected of them; a good journalist, preferably with a scientific bent, is the best possible link between scientist and layman.

(2) Journalists are too often guilty of allowing inaccuracies and misinterpretations to creep into their science-writing; the errors that occur are more often errors of evaluating significance or application than of presentation.

(3) A certain antagonism exists between scientists and journalists. Scientists are not satisfied with the transcriptions of their work and frequently resent the attempts to popularize science. Journalists feel that scientists are often hard to deal with because they are overly insistent upon hair-splitting accuracy.

(4) Technical language is not directly translatable into ordinary language, but must be illustrated by comparison to the very ordinary. In this process, a certain amount of the precise meaning and accuracy of the technical term must be sacrificed. The fine qualifications of scientific terms are, however, useful and necessary only to scientists.

(5) There is unquestionably a need for good science writers: to give the underlying principles and methods of science palpable significance for the nonscientist; to succeed in transferring a visual conception of the connection between scientific research and the products that people use; to translate some of the discoveries in basic, theoretical research into understandable terms and point out some of their possible implications.

(6) Competence in journalism and an interest in science are the only two essentials of a good science writer. The scientific journalist must guard against becoming so familiar with technical terms that he forgets they are not generally familiar.

Scientists in the News

Marvin Carmack, professor at the University of Pennsylvania and consultant to the Los Alamos Scientific Laboratory and to Du Pont, has been appointed professor of chemistry at Indiana University.

David W. Chaney has been appointed assistant director of research for The Chemstrand Corporation.

The Cigar Manufacturers Association of America and the Cigar Institute have awarded **E. E. Clayton,** tobacco pathologist at the Plant Industry Station of the U.S. Department of Agriculture, a plaque and a certificate "for his outstanding research in the development of disease-resistant strains of leaf tobacco."

Certificates of Appreciation of the Department of the Army have been awarded to **G. Robert Coatney** of the Laboratory of Tropical Diseases, National Microbiological Institute, U.S. Public Health Service, and **Ralph Jones, Jr.,** assistant professor of research medicine at the University of Pennsylvania Medical School. The physicians were honored for research work in connection with the development and testing of primaquine, an antimalarial drug.

Watson Davis, director of Science Service, has received a Bausch & Lomb award for significant achievement in the field of science education. The presentation, in the form of an inscribed binocular, was made at the annual dinner of the Washington Academy of Sciences.

Paul H. Emmett, senior fellow of the Mellon Institute of Industrial Research, won the 1953 Pittsburgh Award of the American Chemical Society's Pittsburgh Section. He was cited for distinguished service to chemistry and to the community as a research scientist, lecturer, educator, and inspiration to younger chemists. Dr. Emmett, who was a division chief in the World War II atom bomb project at Columbia University and who before that was head of the Department of Chemical Engineering in The Johns Hopkins University, is internationally recognized for his extensive research on the adsorption of gases and on the use of catalysts.

Douglas H. Ewing has been named director of a newly-formed Physical and Chemical Research Laboratory of the Research Department, Radio Corpora-

tion of America Laboratories Division, the headquarters of which are at the David Sarnoff Research Center, Princeton. Dr. Ewing has been director of Research Services for the Division.

Rhodes W. Fairbridge of the University of Western Australia, Nedlands, is visiting associate professor of geology at the University of Illinois for the current academic year. He is teaching courses in structural and tectonic geology and in petroleum geology.

On Jan. 1 **Robert Gaunt**, Director of Endocrine Research, Ciba Pharmaceutical Products, Inc., Summit, N.J., became chairman of the Advisory Committee which administers the work of the Macrobiology Division. The committee, formed last year, has a rotating chairmanship, with each of three members serving in turn for a one-year term. Dr. Gaunt succeeded **Albert Plummer** who served as chairman of the group during its initial year.

Alfred N. Goldsmith, a co-founder of the Institute of Radio Engineers and its editor since that date, has been awarded the Institute's Founders Award "for outstanding contributions to the radio engineering profession through wise and courageous leadership in the planning and administration of technical developments which have greatly increased the impact of electronics on the public welfare."

At a recent meeting of the American Chemical Society's California Section, **John G. Kirkwood**, chairman of the Department of Chemistry, Yale University, received the Gilbert Newton Lewis Medal in recognition of his research on the chemical forces between molecules and his clarification of the structure of liquids and the behavior of proteins. **Donald J. Cram** of the University of California, Los Angeles, was presented with the California Section Award, conferred annually on a chemist under 40 who has done his major work in one or more of the 11 Western states; Dr. Cram's chief contributions have been in the fields of chemical agents produced by molds and the effects on a chemical's properties of changes in its atomic arrangement.

There have been two appointments to the University of Maryland Physics Department faculty during the past year. **John S. Toll**, previously at Princeton University, was named professor and head of the department. **S. Fred Singer**, formerly with the London branch of the Office of Naval Research, is now an associate professor.

Education

The **Biological Laboratory at Cold Spring Harbor** is offering two specialized summer courses, designed to acquaint research workers with the most important techniques used in bacterial virus research and bacterial genetics. The course on Bacterial Viruses will be held from June 21 to July 10, with Mark H. Adams of New York University in charge; and Bacterial Genetics will be conducted from July 14 to August 3 by E. M. Witkin, V. Bryson, M. Demerec, and staff. A limited number of fellowships covering part of the tuition fees are available for graduate student. Information may be obtained from the Biological Laboratory, Cold Spring Harbor, N.Y.

The **Department of Biological Sciences of Loyola University** of Chicago announces the completion of a new microbiological laboratory to be directed by Frank E. Halleck. The laboratory contains most of the modern equipment and apparatus utilized in microbiological and chemical technique, including an electron microscope. The formal opening will take place Feb. 10, when there will be an exhibit of new scientific equipment manufactured by leading apparatus companies. The department cordially invites anyone who is interested to visit the laboratory and see the exhibits.

In conjunction with the new laboratory, a new curriculum is being offered to students who wish to become professional microbiologists. The curriculum will contain courses that will prepare the student for industrial, medical, and academic research positions. Later, courses will be given that will allow the students to take advanced degrees in the fields of microbial biochemistry.

Howard Hughes, west coast industrialist, has announced the establishment of the **Howard Hughes Medical Institute**, a nonprofit charitable organization incorporated in Delaware that will provide millions of dollars for medical research. Mr. Hughes' initial donation consists of a substantial part of the Hughes Aircraft Company. The project represents many years of planning. Three years ago Mr. Hughes created a program of medical research scholarships and fellowships in anticipation of staffing his new institute.

The Department of Zoology at Columbia University has announced that the **Jesup Lecture Series** is being given this year by Jacques Monod of the Institut Pasteur, Paris. His subject is "Some Aspects of Cellular Growth," and the lecture dates are Feb. 3, 5, 8, 10, 12, 15, 17, and 19.

The **Oak Ridge School of Reactor Technology**, Oak Ridge, Tenn., is now accepting applications for the 1954–55 session. Applications for the class beginning in September *must be submitted by Mar. 15*. Approximately 80 candidates will be selected by the Atomic Energy Commission's Admissions Committee. Students eligible for the 50-week graduate course must hold a bachelor's degree or higher in chemistry, engineering, metallurgy, physics, or engineering-physics. The School is a part of Oak Ridge National Laboratory, which is operated by Union Carbide and Carbon Corporation for the Atomic Energy Commission.

The **University of Minnesota Lake Itasca Forestry**

and Biological Station reports that the 1954 Summer Biology Session will be shifted to the period, June 14 to July 17. This change is expected to allow biological field work at the height of the season; it also permits the addition of ornithological work to the station's program. Joseph Hickey of the University of Wisconsin will lead classes in this field. Other staff members, besides a group of University of Minnesota men, include Alvah Peterson of Ohio State University, who will conduct courses in field entomology and immature insects, and Francis Drouet from the Chicago Museum of Natural History, who will teach algology. Courses given by the University of Minnesota staff include limnology, plant ecology, field mycology, and animal ecology. Detailed information can be obtained from the Dean of Summer Sessions, 966 Johnston Hall, University of Minnesota, Minneapolis 14.

A new $2,600,000 science building is being constructed at **Western Illinois State College,** Macomb. The building will house biology, physics, chemistry, geography and geology, and visual education.

Grants, Fellowships, and Awards

The Albert and Mary Lasker Foundation have announced the fifth annual **Albert Lasker Awards for Medical Journalism.** All newspapermen and magazine writers who have written medical or health articles during 1953 are eligible to compete. *The deadline for entries is Feb. 15.* The awards consist of $500 each, a citation, and a statuette of the Winged Victory of Samothrace. They will be presented to the writers who have produced the best articles, series of articles, editorials, or columns dealing with the improvement of public health or the prolongation of life through medical research or public health programs. The Nieman Foundation for Journalism at Harvard University will continue to administer the Awards. Entry blanks and information may be obtained from the Nieman Foundation, 44 Holyoke House, Cambridge 38, Mass.

The **American Academy of Arts and Sciences** has made the following research grants:

From the Permanent Science Fund

Harvard University. I. B. Cohen, Dept. of History of Science. Development of a guide to the history of American science, $950.

Biblioteca y Museo de Sonora, Hermosillo, Mexico. R. J. Drake, Laboratory of Conchology. Conchological and ethnoconchological research, $300.

Reed College, Portland, Ore. L. H. Kleinholtz, Dept. of Biology. Chemical nature of the reflecting pigments in arthropod eyes, $1455.

University of Wisconsin. N. O. Lurie, Dept. of Anthropology and Sociology. Developing and testing theories of cultural change and cultural stability with special reference to the Winnebago Indians, $1500.

Harvard University. R. E. Schultes, Botanical Museum. Amazonian flora of Colombia, $300.

University of Pittsburgh. E. B. Spiess, Dept. of Biological Sciences. Physiological aspects of population genetics in *Drosophila persimilis,* $1000.

From the Rumford Fund

State College of Washington. D. S. Farner, Dept. of Zoology. Purchase of equipment to be used in the study of incubation and body temperatures of incubating yellow-eyed penguins.

New York Botanical Garden. W. J. Robbins, Director. Purchase of a Beckman spectrophotometer for physiological research involving the employment of light and heat.

The Yale University Graduate School has announced the **American Cancer Society Fellowships in Biometry and Epidemiology** for 1954–55.

Predoctoral fellowships. Applicants must possess the B.A. or B.S. degree and must have a knowledge of biology, chemistry, mathematics and physics. They are expected to enter the Graduate School as candidates for the Ph.D. degree and they will be given training in one or more fields of biology as well as statistics. These fellowships are awarded for a period of three years, but may be terminated at any time if the candidate fails to meet the standards of the University. Stipends will be $2000 per year. Additional funds may be available for students with dependents.

Postdoctoral fellowships. These fellowships are intended for young men and women embarking upon an investigative career and also for more mature investigators desiring to extend their fields of competence. Candidates must be citizens of the United States who possess the M.D., Ph.D., or Sc.D. degree. They are expected to carry out research and will be given training in biometry, biostatistics, and such other subjects as the University may deem necessary. Fellowships are awarded for periods of one year and may be renewed for two additional years. The stipends will range from $3000 to $4500.

For further information, write to Prof. E. Cuyler Hammond, Director of Graduate Studies in Biometry, 51 Hillhouse Ave., Yale University, New Haven, Conn. Application blanks for predoctoral fellowships may be obtained from the Dean of the Graduate School, Yale University, New Haven, Conn. *Applications for both types of fellowships should be mailed by Feb. 28.*

The **College of Medicine at New York City** of the State University of New York has recently received the following new grants:

Department of Anatomy. J. Gross, $2500, from Smith, Kline and French Foundation. Research in the field of endocrinology.

Department of Medicine. B. L. Zohman, $2500, from the Maltbie Laboratories. Therapeutic procedures for combating intractable heart failure.

Department of Medicine. B. L. Zohman, $3000, from Thomas Leeming & Company. Vasodilator drugs in the treatment of coronary diseases.

Department of Medicine. J. L. Brandt, $3500, from the Abbott Laboratories. Effect of protein on hepatic metabolism.

Department of Psychiatry. H. W. Potter, $27,300, from the New York Mental Health Commission. To operate a clinic for alcoholism and conduct researches in connection therewith.

In December the **Damon Runyon Memorial Fund** made the following grants:

Vienna University, Austria. E. Broda, First Chemical Laboratory. Investigations of individual tissue culture metabolism, $6000.

Bronx Veterans Administration Hospital. L. Gross. Leukemia research, $9700.

Stanford University School of Medicine. A. C. Griffin, Dept.

of Biochemistry. Pituitary factors that modify the action of carcinogenic agents, $8200.

George Washington University. P. K. Smith, School of Medicine. Metabolism of radioisotope labeled chemotherapeutic agents in cancer, $5800.

The **Daniel and Florence Guggenheim Foundation** will grant a total of $36,000 for 1954 Guggenheim Jet Propulsion Fellowships for graduate study in rocket and jet propulsion engineering. Object of the fellowships is to select and train outstanding men for basic research and leadership in the future development of rockets and jet propulsion at the Daniel and Florence Guggenheim Jet Propulsion Centers at Princeton University and the California Institute of Technology. Each grant provides for tuition and an allowance for living expenses which ranges from $1000 to $2000, depending on the stage of advancement of the fellow.

Candidates must be residents of the United States, must have outstanding technical ability and leadership qualities, a deep interest in the development of rockets and jet propulsion, and an intention to follow this field as a career. Application blanks have been mailed to major universities, engineering colleges, and industrial and military establishments engaged in work in this field. If forms are not readily available from these sources, candidates should write to The Daniel and Florence Guggenheim Foundation, 120 Broadway, New York 5. *Completed applications must be received by Mar. 1.*

Nominees with outstanding accomplishments in bacteriological and immunological research are wanted for the **16th Eli Lilly and Company Research Award in Bacteriology and Immunology.** This award is open annually to U.S. or Canadian men or women, not over 35, who are working in a noncommercial or educational institution. It consists of $1000, a bronze medal, and up to $150 in traveling expenses. Nominations should be submitted to the chairman of the Nominating Committee, Dr. Geoffrey W. Rake, The Wistar Institute, University of Pennsylvania, Philadelphia 4, *not later than Mar. 1.* No person should submit more than one nomination; it should be accompanied by five copies each of a brief biographical sketch of the nominee, including date of birth, and a list of his publications.

The **Grass Trust for Research in Neurophysiology** will provide one or two fellowships for work at the Marine Biological Laboratory at Woods Hole, Mass., during the summer of 1954. The stipend will be $500 to $1000, depending upon the financial needs of the candidate. Two candidates may apply jointly to work together with stipends of $500 each. The fellowships are designed for young investigators in the predoctoral or early postdoctoral stage. Applications may consist of a brief letter, preferably from some senior investigator who knows the candidate well, describing his qualifications and giving a brief account of his plans for research and how he would use this fellowship. Reprints of published work will also be helpful to the selection committee. Letters and supporting material in triplicate should be sent to Dr. Robert S. Morison, Room 5500, 49 West 49 St., New York 20, *before March 1.*

The **Medical Library Association** is offering four scholarships of $150 each for summer school courses in medical library work in 1954, two at Columbia University and two at Emory University. Applications for these scholarships should be made to the university at the time of application for enrollment. Since credentials must be approved in advance, application for admission should be made as far as possible before the date of opening of the session and sufficiently early in the year to permit the schools to pass upon the credentials and forward applications for scholarship to the Medical Library Association. Transcript of academic records should be submitted to the school even if the applicant is not a candidate for a degree. *May 1 is the Association's closing date for scholarship applications* and candidates must already have been accepted by the school. Completion of either course will enable a student with a bachelor's degree and one year's library school training to qualify for Grade I certification by the Medical Library Association.

The course at Columbia University on The Medical Library is offered July 6–Aug. 13; registration, July 1 and 2. It is a survey and evaluation of library resources in medicine, with emphasis on bibliographical and information sources. Some attention is given to special service problems in medical libraries. For further information write to The Dean, School of Library Service, Columbia University, New York 27.

Emory University offers a course in Medical Libraries July 19–August 21. The purpose is to give an introduction to medical library resources and their use in medical education, medical research, and care of the patient. A major portion consists of a survey of the literature and its bibliographical control. Attention is given to literature searching as an aid in medical investigation. Consideration will also be given to the application of library techniques, administration, and procedures to medical librarianship. For application forms and further information write to The Director, Division of Librarianship of Emory University, Emory University, Ga.

The **National Foundation for Infantile Paralysis,** 120 Broadway, New York 5, has informed the deans of the medical and basic science schools in the United States that fellowships will continue to be available in 1954 for medical students who have completed at least two years of medical school work and who have eight weeks of consecutive free time to devote to extracurricular study. The stipend will be $400.

Three types of fellowships will be offered: (1) research in the basic sciences related to medicine; (2) physical medicine and rehabilitation; (3) public health and preventive medicine. The dean of each school is invited to nominate one candidate for the

research fellowship and two candidates for each of the other fellowships. Since the purpose of these programs is to enable the student to determine his own ability and aptitudes early in his career, no student who has had an equivalent orientation will be eligible. For further information and application forms, students should consult with the deans of their respective schools. *Applications should be submitted to the National Foundation for approval at least eight weeks prior to the beginning of the program.*

Gifted science students desiring tuition-free opportunities in the coming **Summer Studies Program at the Roscoe B. Jackson Memorial Laboratory** at Bar Harbor, Maine, *must apply by Mar. 1.* Applications were received for last summer's course from five times as many secondary school students and many more college students than could be accepted for the unique ten-week research program offered by this center for the study of heredity of cancer and allied diseases. This year there is a maximum of 27 secondary school places and 26 college level places available. Applications should be sent to the Administrative Director of the Laboratory.

The **University of Hawaii** has announced a $4000 research fellowship in the social or biological sciences for 1954–55. An applicant is expected to have completed at least two years of graduate study in his field of specialization. He must submit a detailed plan for original research in some aspect of Pacific Islands study, preferably to be carried out in the field. *Applications should be received by May 1.* Forms are available from the Dean of Faculties, University of Hawaii, Honolulu 14, Hawaii.

Surgeon General Leonard A. Scheele of the **U.S. Public Health Service** has approved the award of 651 medical research grants in aid which come to a total of $6,428,435. His action was taken on recommendations by advisory councils to National Institutes of Health at their November–December meetings. In February, the councils meet again to allocate the small amount remaining from $28,866,000 that was appropriated for research grants in 1953–54. At that time they will also start consideration of applications for the fiscal year beginning July 1, although sums to be available will still be uncertain. The new approvals are as follows.

Arthritis and metabolic diseases: 67 projects, $606,031; applications totaled $1,003,116, for 98 projects.

Neurological diseases and blindness: 49 projects, $441,312; applications, $1,838,071, for 97.

Cancer: 215 projects, $2,055,155; 253 applications for $2,654,120.

Dental: 5 projects, $20,342; 11 applications for $74,390.

Microbiology: 64 projects, $579,060; 100 bids for $867,189.

Heart: 93 projects, $1,058,636; 152 for $1,878,298.

Mental health: 67 projects, $821,963; 123 for $1,884,291.

General: 91 projects, $845,936; 137 applications for $1,467,511.

Meetings and Elections

At the recent meeting of the **Florida Academy of Sciences** the following officers were elected: pres., J. C. Moore; sec.-treas., R. A. Edwards (re-elected). Counselers-at-large are Clyde Reed of Tampa and Dan A. Thomas of Winter Park. Under academy procedure, officers will not assume their posts until next December. S. de R. Diettrich of the University of Florida, elected a year ago, has succeeded C. S. Nielson of Florida State University as president for the current year.

The **Histochemical Society** will meet at Atlantic City, Apr. 16–17, following the session of the American Society for Experimental Pathology. A symposium on "Basophil Components of Cytoplasm" will be held on Apr. 16.

On Mar. 14–16, the **hundredth anniversary** of the birthdays of Paul Ehrlich, the "Father of Chemotherapy," and Emil von Behring will be celebrated by a commemoration ceremony to be held in Frankfurt, Germany. The ceremony, organized by the Paul-Ehrlich-Institute and the University of Marburg and Frankfurt, will be attended by high government officials, and by scientific and cultural representatives from many countries.

The Paul-Ehrlich- and Ludwig-Darmstaedter-Prize, which is awarded for notable achievements in the fields of science to which Ehrlich made prominent contributions, will be presented to E. B. Chain, recipient in 1945 of the Nobel Prize for Physiology and Medicine. He will deliver the prize lecture on the subject, "Development of Antibiotic Chemotherapy." Prof. Chain, formerly of the University of Oxford, is at present the Scientific Director of the International Research Center for Chemical Microbiology in Rome.

The **International Congress on Photobiology** organized under the auspices of the Comité Internationale de Photobiologie (C.I.P.) will be held in Amsterdam, Aug. 23–28. In addition to contributed papers, there will be three symposia: "Photoperiodism in Plants and Animals"; "The Effects of Nonionizing Radiation on Genetic Elements of Cells"; and "The Fundamental Effects of Light on Skin." The Committee on Photobiology of the Division of Biology and Agriculture, National Research Council, has limited funds available, contributed by the National Science Foundation, for the support of this Congress. For further details write to the secretary of the American Branch of C.I.P., Alexander Hollaender, Oak Ridge National Laboratory, Biology Division, P. O. Box P, Oak Ridge, Tenn., or to the Secrétariat du Congrès

C.I.P., Radiologisch Laboratorium, Wilhelmina Gasthuis, Amsterdam, Holland.

The Office of Naval Research and the University of Pennsylvania have announced a symposium on **"Origins of Drug Resistance,"** to be held Mar. 25–27 at the Hotel Statler in Washington, D.C. Five sections are planned: "Origins of Drug Resistance in Microorganisms," "Effects of Acridines and Resistance to Insecticides and Herbicides," "Origins of Tolerance and Addiction to Drugs, and Alcoholism," "Resistance Factors in Infectious Agents and Cancer Cells," "Physiological, Chemical and Genetic Viewpoints." Speakers will include: H. B. Newcombe, V. Bryson, W. Szybalski, Harriet Ephrussi, A. C. R. Dean. B. Ephrussi, Charles E. Minarik, Richard Kuhn, Leigh E. Chadwick, Nathan B. Eddy, J. H. Quastel, Ebbe C. Hoff, Roger J. Williams, Lloyd W. Law, James A. Miller, Elizabeth C. Miller, Morris K. Barrett, Howard A. Schneider, Herschel K. Mitchell, M. G. Sevag, and Ralph W. Gerard. The speaker at the banquet will be C. P. Martin of McGill University, who will address the group on "Theories of the Mechanism of Evolution." Further information may be obtained from Dr. M. G. Sevag, School of Medicine, University of Pennsylvania, Philadelphia 4.

Phi Delta Kappa has elected the following officers: pres., Emery Stoops, University of Southern California, Los Angeles; 1st v. pres., M. L. Cushman, Iowa State College, Ames, Iowa; 2nd v. pres., J. Roy Leevy, Purdue University, Lafayette, Ind.; rec. sec., John C. Whinnery, Superintendent of Schools, Montebello, Calif.; comptroller, Maynard Bemis, University of Wyoming, Laramie, Wy.

Last month the New York Academy of Sciences sponsored a two-day conference on **"Recent Advances in the Study of the Structure, Composition and Growth of Mineralized Tissues."** Roy O. Greep, Dean, Harvard School of Dental Medicine, and Albert E. Sobel, Head, Department of Biochemistry, Jewish Hospital of Brooklyn, and professor of biochemistry at the Polytechnic Institute of Brooklyn, were cochairmen of the conference. Twenty-one scientists from the United States, Canada, and England presented papers on the important advances in the fundamental knowledge of the three mineralized tissues of the body: bones, enamel, and dentin of teeth.

A three-day conference on **Tissue Culture Technique in Pharmacology,** sponsored jointly by the New York Academy of Science, Section of Biology, and the Tissue Culture Association, Duke University, took place recently in New York City. This conference brought together outstanding investigators from the leading universities, research laboratories, hospitals, the National Cancer Institute, and pharmaceutical houses in the United States and from abroad. A total of 27 papers were presented. C. M. Pomerat, University of Texas Medical Branch, Galveston, and Elmer L. Sevringhaus, Director of Research, Hoffman-La Roche, Inc., Nutley, N.J., were cochairmen of the conference.

Guest speakers from abroad were: Jean Verné of the University of Paris, a delegate of the French Government; J. Fréderic of the University of Liége, Liége, Belgium; Dr. and Mrs. Hans Lettré, University of Heidelberg, Heidelberg, Germany; and Honor B. Fell, Strangeways Research Laboratory, Cambridge, England.

Sessions covered "Pure Strain, Long Term and Mass Culture Methods, Commercial and Synthetic Media—Virology;" "Special Assay Technique: Comparison between *in vitro* and *in vivo* Results;" and "The Action of Chemical Agents on Cell Organoids and Mitosis."

Miscellaneous

A new Hall of Insects and Other Invertebrates will be opened in the **Academy of Natural Sciences of Philadelphia** with a preview for members on the evening of February 16, 1954. Following the preview, the hall will be open to the public as a part of the Museum.

The **Chemical-Biological Coordination Center** is reviewing the publication habits and related research practices of American biologists. In connection with this study the Center is seeking sources of unpublished data from research in all areas of biology where the effects of chemicals on biological systems are involved. The first returns from a nationally distributed one-page questionnaire have shown a most encouraging degree of interest. The Center is grateful for the cooperation it is getting, and urges that all biologists who receive a questionnaire during the next few months complete and return it as soon as possible.

The survey is intended to improve the efficiency of the CBCC as a research tool whose primary function is to coordinate and speed up the dissemination of facts and ideas from original research in the biological sciences. The results of the study will be analyzed, and distributed to all those who are interested. Inquiries regarding the CBCC may be addressed to: Dr. Karl F. Heumann, Chemical-Biological Coordination Center, 2101 Constitution Avenue, NW, Washington 25, D.C.

The story of how twelve European nations have agreed to cooperate in nuclear research for nonmilitary purposes is reported by the United Nations Educational, Scientific and Cultural Organization in the December issue of *Courier,* its monthly magazine. The article on the **European Organization for Nuclear Research** (CERN) which plans to erect a tremendous central laboratory near Geneva, is one of a series in the 16-page special section on peacetime uses of atomic energy. UNESCO's examination of this problem is of particular interest because of President Eisenhower's recent address at the United Nations on the use of atomic power for peace.

Technical Papers

Pentobarbital Inhibition of Sulfanilamide Acetylation in Pigeon Liver Extracts

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Recently a great deal of interest has been shown in the effects of narcotic and hypnotic drugs on acetylation systems, and particularly on the system involving acetylcholine synthesis. McLennan and Elliott (*1*) have postulated that pentobarbital inhibits the choline acetylase system directly, whereas Johnson and Quastel (*2*) prefer the explanation that pentobarbital and other hypnotics interfere with oxidative synthesis of adenosinetriphosphate, thus indirectly resulting in impaired acetylcholine synthesis. In addition to using a brain choline acetylase system, the latter authors have employed an unaged fluoride containing aqueous extract of pigeon liver acetone powder added to rat brain homogenate for aerobic acetylation of sulfanilamide as well as the same pigeon liver extract alone, anaerobically. The addition of adenosinetriphosphate (ATP) to the aerobic system resulted in reduction of the considerable inhibition produced by chloretone. In the anaerobic pigeon liver system pentobarbital and other barbiturates, as well as chloretone, produced only very slight inhibition.

When one considers the acetylation of sulfanilamide by pigeon liver preparations several points must be borne in mind. Fresh pigeon liver homogenates are able to acetylate sulfanilamide aerobically. This ability is lost to extracts of acetone powders but acetylation proceeds anaerobically when ATP is added (*3*). Johnson and Quastel have succeeded in using rat brain homogenate as a source of supply of ATP.

In addition to the acetylation mechanism, unaged pigeon liver extract contains large quantities of coenzyme A (Co A) together with an enzymic mechanism for splitting the Co A molecule (*4*). Aging of pigeon liver extracts results in the removal of endogenous Co A, thus making aged extracts useful in the assay of Co A (*5*). Additionally, pigeon liver extracts have the ability in the presence of ATP to resynthesize Co A from split products including pantethine (*6, 7*) and phosphopantethine (*8*). The addition of fluoride (as employed by Johnson and Quastel) blocks dephosphorylation in the enzymic breakdown of Co A by liver (*4*).

Thus it occurred to us that Johnson and Quastel (*2*) in their aerobic system, may have not been dealing with a direct effect of ATP in removal of narcotic inhibition but actually with a replenishing of the Co A supply which in turn may have been more directly concerned with inhibition noted. Along the same line of reasoning, their failure to obtain inhibition with narcotics and hypnotics in the anaerobic pigeon liver system may have been due to the presence of adequate supply of Co A or split products which are convertible to Co A in the presence of ATP.

In this paper we wish to report the effect of added Co A on the inhibition of sulfanilamide acetylation produced by pentobarbital in aged pigeon liver extracts.

Aged bicarbonate extracts of acetone dried pigeon liver powder were prepared in the manner of Kaplan and Lipmann (*5*). A reaction mixture containing the following substances was used: sulfanilamide, 0.04*M*, 10 ml; sodium acetate, 1*M*, 2.5 ml; Na_4 ATP, 0.05*M*, 8.0 ml; sodium citrate, 0.2*M*, 10 ml.

To each tube was added the above reaction mixture, 0.3 ml; pigeon liver extract, 0.3 ml; tris-hydroxymethylaminomethane buffer 1*M*, pH 8.0, 0.1 ml; cysteine hydrocholoride, 0.1*M* (freshly prepared), 0.2 ml; coenzyme A, 0–5 u in 0.1 or 0.2 ml of aqueous solution; pentobarbital-Na when added, 0.2 ml of aqueous solution of appropriate concentration to make the final molarity required (usually 1–3 millimolar). The final volume was 1.3 ml. These tubes were incubated for 1 hr at 37° C without shaking. Free sulfanilamide was determined on the trichloracetic acid filtrates by the Bratton-Marshall (*9*) procedure. Blank tubes containing all reagents except Co A were run, including blanks containing pentobarbital. Values obtained from tubes containing pentobarbital were subtracted from the pentobarbital-containing blank value. The results are recorded as ΔD, the difference between the spectrophotometer reading of the blank and that of the Co A-containing tubes. This represents disappearance of free sulfanilamide or accumulation of acetylsulfanilamide.

As shown in Table 1, the addition of pentobarbital in final concentrations of 1–3 millimolar results in appreciable inhibition of acetylation of sulfanilamide when aged pigeon liver extracts are used under anaerobic conditions. The addition of more Co A reduces the magnitude of the inhibition. This finding does not invalidate the postulate of Johnson and Quastel, that pentobarbital depresses ATP synthesis.

TABLE 1. Sulfanilamide acetylation.

	Pentobarbital Concentration					
	1 mM		2 mM		3 mM	
	ΔD	% inhibition	ΔD	% inhibition	ΔD	% inhibition
Co A 1 u	0.104		0.109		0.099	
Co A 1 u + PB	0.089	14.4	0.073	33.0	0.050	49.5
Co A 5 u	0.230		0.244		0.226	
Co A 5 u + PB	0.210	8.7	0.208	14.8	0.159	29.7

However, pentobarbital evidently does have an inhibitory effect on the acetylation system when small amounts of Co A are used, in the presence of preformed ATP. The lessening of inhibition when more Co A is added strongly suggests that pentobarbital has a direct effect on the acetylation system and that any effect on ATP synthesis may be in addition to its effect on the coenzyme A-apoenzyme complex or the formation thereof. It is possible that the lack of inhibition noted by Johnson and Quastel in the unaged pigeon liver system may be due to a large excess of Co A in the system. The failure of Co A to be irreversibly broken down in their preparation may be due to the presence of fluoride or the instability of the catabolic enzyme (*5*). In the case of the coupled rat brain-pigeon liver system of Johnson and Quastel, one must postulate a lower level of Co A, since ATP is effective in reducing the inhibitions described. This is borne out by the assays of Co A in tissues reported by Kaplan and Lipmann (*5*).

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Depigmentation of Hair as a Biological Radiation Dosimeter

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Exposure of large numbers of mice to graded doses of whole-body ionizing radiation at the Eniwetok weapon tests in 1951 gave an opportunity to evaluate radiation-induced depigmentation of fur as a biological dosimeter. The feasibility of such a study was indicated by earlier experiments in which decolorization of hair had been correlated with the dosage of x-radiation (*1–3*).

As early as 3 mo postirradiation graying of fur was detected in many of the more heavily irradiated LAf_1 mice; their normal coat is brown over the entire body. As the animals were genetically uniform males and females of approximately the same age, irradiated simultaneously, the degree of depigmentation appeared to be correlated with the dose of radiation. Accordingly, random samples from a colony of over 3000 mice exposed at 16 dose levels, were examined and the pattern of graying recorded as follows. The coat of each mouse was divided into 6 regions: (1) top of head (scalp), (2) nuchal region, (3) supraclavicular area, (4) anterior chest and abdomen, (5) scapular area, and (6) lumbo-sacral region. Each area was observed grossly for coat color, and the degree of depigmentation was graded on an integral scale from 0 to 4, zero indicated no change from the normal brown color, and 4 designated pure white, or complete depigmentation. Repeated examinations of the same mice, made at intervals of 2 mo, revealed that the decolorization progressed during the passage of time. Therefore, an attempt was made to fit a linear function to the date, which would best relate the depigmentation of the 6 regions specified to the dose at a given time postirradiation.

The function postulated assumed the form

$$\bar{d} = \lambda_0 + \lambda_1 p_1 + \lambda_2 p_2 + \lambda_3 p_3 + \lambda_4 p_4 + \lambda_5 p_5 + \lambda_6 p_6,$$

where p_i is the degree of depigmentation at region i ($i = 1, 2, \cdots, 6$) and λ_i is a fitted, constant coefficient, so chosen as to maximize the ratio of the differences between means of the dose groups to the variation within each group. The procedure followed considered each region separately, then all combinations of 2 regions, then 3, and so forth, until the variation about the line or plane was not significantly reduced by the addition of another variable.

Representative data, covering the examinations made 7 and 17 mo postirradiation, are presented. Two hundred and thirty-nine mice, exposed at 16 dose levels, including nonexposed controls, were surveyed at 7 mo. At 17 mo the surviving 174 mice of this sample were re-examined. In each case the top of the head (scalp) was the region of the least variation about the fitted line. However, this function was not completely satisfactory, because those animals receiving high doses of radiation were uniformly white over the top of the head ($p_1 = 4$) and those exposed to low doses did not exhibit evidence of depigmentation ($p_1 = 0$). The animals in the extreme dose groups were, therefore, omitted and the procedure was repeated for the 138 and 116 mice examined at 7 and 17 mo, respectively. They received between 287 and 687 r. The radiation was a mixture of gamma rays and neutrons of varying energies, predominantly the former. Again a significant decrease in the variation resulted from consideration of the top of the head alone. The 2 resulting equations are of the form

$$\bar{d} = \lambda_0 + \lambda_1 p_1,$$

where λ_1 represents the average increase in the dose per unit increase in depigmentation and λ_0 may be interpreted as the upper bound for the dose received when there is no depigmentation. The parameters estimated from the data are summarized in Table 1 and the lines are exhibited graphically in Fig. 1. The slopes, or λ_1's, of the lines do not differ statistically, but there is a definite significant statistical difference between the intercepts, or λ_0's.

These findings represent a shift of the line downward and to the right during the 10 intervening mo. This is interpreted as indicating a uniform increase in degree of depigmentation among dose groups dur-

TABLE 1. Parameter estimates and standard errors of depigmentation dosimetry equation.

Months after irradiation	Number of mice	λ_0	λ_1	Standard error of λ_1	Standard error of estimate about line
7	138	313.22	85.97	2.71	51.42
17	116	253.75	92.30	4.05	62.80

ing this period. The same increment in expected dosage per unit of increase in depigmentation existed at both times, but at 17 mo the threshold was 254 r (reading from the line), whereas at 7 mo there was no discernible graying below 313 r.

The correlation between dose and depigmentation varied markedly with different regions of the coat, and occasionally gave rise to a mottled appearance of the fur. Sharply demarcated areas of brown (grade 0) and white (grade 4) hair were at times in juxtaposition to one another. This is best explained by postulating the existence of differences in the radiosensitivity of hair follicles of various areas at the time of irradiation. Chase has shown that the susceptibility of individual hairs to graying varies markedly, and depends upon such factors as the stage of the growth cycle and the type of the hair follicle (*4*). No attempts were made to characterize the development of the hair follicles of LAf_1 mice or to determine by microscopic count the anatomical distribution of the various types of follicles, but the observed pattern of depigmentation suggests the contours of the moulting patterns described by Dry (*5*). As the mice of this experiment were irradiated at the age when moulting was presumably in progress, it is logical to attribute regional variations in degree of depigmentation, as observed, to differences in radiosensitivity of hair follicles due to moulting.

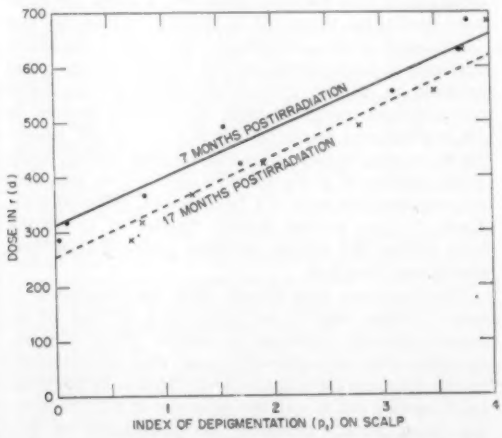

FIG. 1. Estimated dose as a function of depigmentation.

It may be concluded that the degree of depigmentation of fur of mice of the LAf_1 strain is closely enough correlated with the dose of radiation to constitute a convenient biologic dosimeter. This correlation, however, varies markedly with different regions of the coat, and for the mice studied it is more constant for the fur of the top of the head than for that of other areas examined. The greater constancy for the top of the head is attributed to the tendency of all hair follicles in this region to be resting during the age at which the mice were exposed (*2, 5*). The progression of depigmentation of various areas probably resulted from gradual replacement of old colored club hairs by postirradiation depigmented hairs, as several hair generations are usually represented in each follicle at any given time (*2, 5*).

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Nitrate Formation by a Soil Fungus[1]

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Nitrification in soil is a biological process of paramount importance to the nutrition of green plants, for the nitrate nitrogen that is the end product of this process serves as the principal form in which nitrogen is used by photosynthetic plants. Ever since the classical researches of Winogradsky around 1890, the process of nitrification has been attributed to the activity of a few genera of highly specific, strictly autotrophic soil bacteria which oxidize ammonium nitrogen to nitrate in a two-step reaction. In recent years evidence has suggested that certain heterotrophic microorganisms isolated from soil may participate in the first stage of nitrification, the production of nitrite nitrogen. Quastel *et al.* (*1*) reported the isolation of three species of soil bacteria capable of oxidizing pyruvic acid oxime and the oximes of certain other alpha-keto acids to nitrite. Jensen (*2*) found isolates of two additional genera of soil bacteria, and numerous isolates of the actinomycete species *Nocardia corallina* capable of producing nitrite from pyruvic oxime. The oxidation of ammonium nitrogen to nitrite has been observed also for a soil actinomycete of the genus *Streptomyces* (*3*), various unidentified heterotrophic

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TABLE 1. Production of nitrite and nitrate from organic nitrogen by a strain of *Aspergillus flavus* isolated from soil.

Days of incubation	pH		Dry wt of mycelium, mg		NO_2^-–N γ/ml		NO_3^-–N γ/ml	
	Shaken	Static	Shaken	Static	Shaken	Static	Shaken	Static
0*	7.2	7.2	—	—	0.01	0.01	2.0	2.0
4	8.1	6.9	192.1	124.3	0.10	0.55	8.0	11.1
7	8.6	7.7	178.8	154.8	0.27	1.14	27.0	28.0
11	8.7	8.3	148.0	157.0	0.21	3.20	17.6	26.8
16	9.2	8.4	131.9	149.8	0.35	1.13	20.2	24.5
25	8.2	8.2	133.9	160.6	0.45	1.32	26.3	26.5
32		8.1		155.7		1.50		34.0
39		8.5		154.0		1.51		35.0

* Control flask plus inoculum.

soil bacteria (*4*), and methane-oxidizing bacteria (*5*). In discussing the possible importance of nitrite production by heterotrophic organisms to the nitrogen economy of the soil, Jensen (*2*) emphasized that no organism other than the autotrophic *Nitrobacter* is yet known to accomplish the second stage of the soil nitrification reaction, the oxidation of nitrite to nitrate. The present communication records a soil fungus, *Aspergillus flavus*,[2] capable of producing nitrate nitrogen.

The *A. flavus* isolate was discovered during an investigation of the relationship of nitrate production in Minnesota soils to nitrate-induced methemoglobinemia in infants. The organism was obtained from dilution plates of a farmyard soil on glucose (1%), yeast extract (0.2%), and agar (1.5%) medium. Nitrification reactions resulted from the growth of the fungus in a liquid medium containing organic nitrogen. The culture medium consisted of dipotassium phosphate 0.1%, magnesium sulfate 0.15%, ferrous sulfate trace, manganous sulfate trace, glucose 0.2%, peptone 0.4%, and yeast extract 0.1%. Organic constituents of the medium were autoclaved apart from the mineral salts solution. Nitrite was determined colorimetrically by the Gries-Ilosvay method. Nitrate in the presence of nitrite was determined by first oxidizing the nitrite with a few drops of hydrogen peroxide and then measuring total nitrate by the phenoldisulfonic acid method. Culture filtrates were measured directly for pH and ammonia, and were decolorized with charcoal for nitrite and nitrate assays. Uninoculated control flasks were analyzed at the end of each incubation period and corrections were made for the slight positive values (0.01 γ/ml NO_2^-N, 2.5 γ/ml NO_3^-N) observed.

TABLE 2. Ammonium production during static culture in the course of the nitrification of organic nitrogen by a strain of *Aspergillus flavus* isolated from soil.

Days of incubation	pH	NO_2^-–N γ/ml	NO_3^-–N γ/ml	NH_4^+–N γ/ml
0	7.2	0.14	3.0	8
7	7.9	0.29	7.4	116
12	8.3	0.83	21.3	366
18	8.4	0.45	9.2	282
24	8.1	0.74	19.3	258
30	8.4	0.67	16.1	132

[2] The author is indebted to C. M. Christensen, Department of Plant Pathology and Agricultural Botany, University of Minnesota, for the identification of the isolate.

The results summarized in Table 1 extend the list of heterotrophic microorganisms that produce nitrite nitrogen to include a fungus. Of much greater interest is the fact that nitrate nitrogen resulted from the growth of the *A. flavus* isolate. These data present the first indication of the existence of heterotrophic microorganisms capable of carrying the nitrification reaction to completion with the formation of nitrate. Nitrate concentrations were found to build up rapidly during the period of most active cell synthesis in both static and shaken cultures. Maximal nitrate concentrations however were produced after more prolonged incubation. Nitrite nitrogen remained at about the same level during the course of incubation, apparently due to oxidation of the nitrite to nitrate. Table 2 illustrates that only a small portion of the organic nitrogen was oxidized to nitrate. Ammonium nitrogen constituted the principal inorganic form of nitrogen present in the medium and accounted for the rise in pH. Subsequent to observations with the original isolate, additional isolates of *A. flavus* were obtained on rose bengal-streptomycin agar (*6*) from several different soils. Each of these isolates proved capable of producing both nitrite and nitrate nitrogen under the cultural conditions described.

The foregoing data clearly show the occurrence in soils of fungi capable of oxidizing a portion of an organic nitrogen substrate to nitrate. While such observation does not necessarily mean that heterotrophic microorganisms participate in nitrification as the process is carried out in soil, the existence of nitrate forming fungi greatly enhances the plausibility of this hypothesis. Studies are now underway to determine the abundance of nitrifying fungi in soils, and to de-

termine the conditions necessary for nitrate production, in an atempt to evaluate the importance of heterotrophic nitrification by fungi.

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A Method for the Quantitative Determination of Hyaluronic Acid in the Human Intervertebral Disk

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The presence of acid mucopolysaccharides in certain tissues and cells has been established by various well-known histochemical methods (*1–3*). The most widely used procedure is that which demonstrates metachromasia when specific basic dyes, e.g., toluidine blue, combine with the acid mucopolysaccharides present in the interfibrillar substance of the mesenchymal tissue (*4*). Furthermore, it has been shown that N-acetylglucosamine and glucuronic acid are formed in equimolecular proportions as a result of the depolymerizing action of hyaluronidase on these hyaluronate substrates. In an attempt to evaluate the potential role of hyaluronic acid in the pathogenesis of ruptured intervertebral disk, we have used a procedure based on the colorimetric method for the determination of N-acetylglucosamine, as described by Mueller (*5, 6*).

Fragments of fresh intervertebral disk obtained at operation are washed with copious amounts of physiologic saline solution until they are free from gross blood. These fragments are then frozen and sectioned at 25 μ using the usual tissue microtome. The masses of sectioned material, weighing 0.1–3.0 g, are then divided into 3 parts and carefully weighed in large test tubes; 1.0 ml of 0.1 *M* phosphate buffer, pH 6.8, is added to each specimen, and 2 *M* NaCl solution is added in sufficient quantity to obtain a relatively fluid mixture, the amount varying with the quantity of disk tissue. Six to eight thousand viscosity units of crystalline testicular hyaluronidase are added to this mixture, with constant shaking. The samples are agitated in a constant temperature water bath at 37–38° C. After 6 hr incubation, 2–4 thousand viscosity units of hyaluronidase are again added. The mixture is incubated 2 hr more, and filtered through No. 1 semiquantitative filter paper. Colorimetric determination of N-acetylglucosamine in the filtrate is carried out in the following manner on each sample.

One milliliter of filtrate and 0.5 ml $N/2$ Na_2CO_3 solution are placed in a large test tube and carefully mixed by shaking. The tube is placed in a boiling water bath for 5 min, then rapidly cooled in tap water. To this solution are added in order: 6.5 ml glacial acetic acid, 1.0 ml acidulated solution of recrystallized *p*-dimethylaminobenzaldehyde (*6*), and 1.0 ml glacial acetic acid. The solution is mixed thoroughly and permitted to stand for 45 min; colorimetric comparison is made, using a standard solution of N-acetylglucosamine. The amount of hyaluronic acid per gram of intervertebral disk may then be calculated from the quantity of N-acetylglucosamine released by similar enzymatic hydrolysis of a known quantity of purified hyaluronic acid.[1]

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[1] Purified hyaluronic acid supplied by the Schering Corp.

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A Cooperative Multiple-Choice Apparatus

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During an extensive investigation of learning in the chronic schizophrenic (*1–3*), the authors required an apparatus, or problem-solving material, for studying the process of cooperation. As the major project was an investigation of the possibilities of learning (over a three-month period) as therapy in chronic schizophrenia, and as the absence of interpersonal relationships is an obvious characteristic of these patients, the need for some form of cooperative learning seemed evident. In this work the conventional learning materials of experimental psychology were used. These permit objective recording of errors and correct responses, the timing of separate trials, and a study of the gradual improvement of performance with practice. The method described here is, the authors believe, the only one so far developed for studying human cooperation in the same way.

The apparatus consists of two identical multiple-choice boxes. In individual learning with one box the subject is faced with a bank of 10 levers each of which can be pulled toward him a distance of 3 in. (A picture of one of these boxes in use appeared in *Life*, Oct. 20, 1952, p. 80.) The subject pulls the levers in any order he wishes until he hits upon the "correct" one, which of course is determined by the experimenter on the other side of the apparatus. Reward for correct responses is given in the form of candy in a tray which moves forward from beind a transparent plastic screen. The operation of one multiple-choice

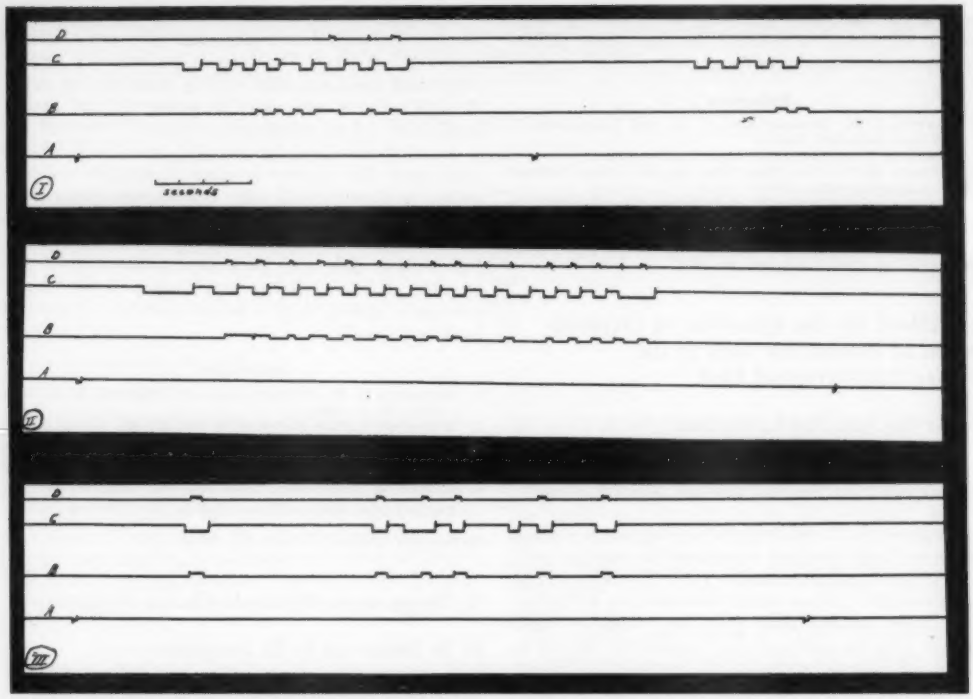

FIG. 1. Three segments of record paper. A mark on *A* indicates the start of a trial; the end of a trial of course comes where two coordinated reactions precede another mark. Line *B* moves up for every reaction of one subject; line *C* moves down for every reaction of the other subject. A mark on *D* indicates that the two reactions below, on *B* and *C*, were the same, i.e., the same lever was pulled by both subjects.

I shows an early trial of two subjects and the beginning of the following trial. *II* shows a later trial by the same two subjects on the same problem. Note the increase in frequency of marks on *D* and the improved coordination, or timing of pulls. *III* is a trial by two different subjects who have had a great deal of practice with the cooperative multiple choice apparatus.

box in the study of individual learning and the various problems which have been used are described in previous studies (*2, 3*). The cooperative multiple-choice apparatus consists of two of these boxes wired in such a way that the correct lever will not work unless pulled on both boxes simultaneously. The wiring necessary to accomplish this coordinated action is relatively simple and can be worked out in a few moments by anyone familiar with electric circuits.

According to the procedure used, the two patients whose cooperative learning is to be studied are first brought to a high practice level in the solution of multiple-choice problems. These consist of first a single lever problem, in which the same lever works every trial, an alternation from trial to trial of two of the levers, the rotation of three of the levers, the middle one of odd numbered levers, and so forth.

In the study of cooperation, two subjects attack the same problems, beginning with the simplest one. They are seated at one side of a table, about 3 ft apart. Preliminary instructions, which are very brief, consist of demonstrating to the two subjects that a "correct lever" will not release the tray when pulled on only one apparatus, but that if it is pulled simultaneously on both, both of the trays will be released.

The subjects' responses are recorded by a simple polygraph with four electrically activated markers (Fig. 1). One of the markers, *A*, is used by the experimenter to mark the start of a trial; another, *B*, shows a mark for every lever-pulling response of one of the subjects; a third, *C*, shows the same for the other subject. A fourth marker, *D*, is activated when the same levers on both boxes are pulled simultaneously. The only one of these markers which is operated at the will of the experimenter is the first.

The cooperative multiple-choice apparatus has the features of learning materials used in conventional experimental work: (1) there is an unlimited number of problems of the same quality but of roughly graded difficulty; (2) the process of learning is divisible into separate trials, thus permitting a study of parts of the process; (3) errors and correct responses are precisely defined and are objectively distinguishable.

The unique feature of the apparatus is its isolation

of cooperation as a process which has a measurable improvement and objective criteria of success and perfection. The preliminary practice level eliminates the individual learning phase. Each subject is equally necessary to the solution of the problem, and each is equally rewarded. Competition between subjects is eliminated, although the usual factors of the cooperative relationship, such as dominance, submissiveness, and initiative, are also allowed to operate. The level of cooperation can be measured in at least three ways: (1) by the number or proportion of responses in unison per trial; (2) by the number or proportion of the same levers pulled simultaneously; and (3) by the time gap between patients' pulls. The first two of these clearly tend to increase with practice.

With this method, it was found that extremely regressed schizophrenics, at least those who have previously been brought individually to a high practice level at multiple-choice learning, can learn to cooperate with one another. Qualitative features of their interaction behavior are also evident and tend to point up a fixed pattern for each individual's cooperative behavior. These features are observed and tallied on a specially prepared trait sheet during the experimental sitting. They include watching the levers pulled by partner, telling him which levers to pull, holding back a lever until partner pulls the same, and actually telling the other patient the principle of the solution. It is possible to wire together more than two of the multiple-choice boxes, thus permitting the study of cooperation in a group of several individuals.

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Manuscript received November 25, 1953.

The Potential Value of Sulfaguanidine in Urology[1]

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Following a review on absorption and excretion of sulfaguanidine, a new therapeutic rationale for the use of sulfaguanidine is suggested.

Since 1940, texts have generally stated that sulfaguanidine is slowly and/or poorly absorbed from the gastrointestinal tract. Dosages of approximately 20 g in a day have been used for thousands of persons with bacillary dysentery, and as much as 60 g in a day have been given (*1*). The facts that blood levels remain relatively low (*2–5*) and that toxic manifestations occur infrequently (*2–10*) have probably contributed toward false impressions about the actual situation in regard to absorption of sulfaguanidine.

There is considerable literature dealing with the absorption and excretion of sulfaguanidine. Beling and Abel (*11*) found concentrations of sulfaguanidine in the urine varied from 25 to 200 mg %, while concentrations of the drug in the blood remained within the narrow limits of 1.5 to 1.8 mg %. Anderson and Cruickshank (*2*) found concentrations in urine as high as 240 mg %; and in blood, 3 mg %. Jamieson, Brodie, and Stiven (*8*) found as much as 154 mg % in urine. Fairley and Boyd (*12*) mentioned that sulfaguanidine is absorbed to a large extent when very small doses are given, but to a small extent when larger doses are given. Hawking (*13*) considered the possibility that sulfaguanidine appears to be poorly absorbed because it is in fact first absorbed from the intestine and then excreted from the blood back into the intestine, but he demonstrated that this hypothesis was not valid. Hubbard, Butsch, and Aaron (*14*) thought that the apparent failure of absorption of sulfaguanidine might be due to removal of the drug from the blood stream by the liver and its return to the intestine in the bile. They proved this is not the case. Rose and Spinks (*15*) postulated that poor absorption of sulfaguanidine might be accounted for on the basis of its molecular structure. They failed to find direct evidence to substantiate this idea.

Investigations, into excretion in 45 normal healthy young men, indicate that sulfaguanidine is often well absorbed and rapidly absorbed. The combined effect of absorption from the gastrointestinal tract and excretion into the urinary tract is such that higher titers of

TABLE 1. Excretion of sulfaguanidine by five persons.

Experimental individual	Oral dose (g)	Av. conc. free drug in urine during stated time interval following administration	Yield of dose in urine during stated time
Ingalls	4	107 mg % at 3–6 hr	15.0% in 8 hr
Pearl	2	126 mg % at 1–3½ hr	11.5% in 3½ hr
Parker	2	168 mg % at 1¾–6½ hr	13.5% in 6½ hr
Greenberg	3	176 mg % at 1¾–3 hr	6.0% in 3 hr
Slivko	3	210 mg % at 4½–13 hr	42.0% in 13 hr

TABLE 2. Rapidity with which drug appears in urine.

Experimental individual	Oral dose (g)	Conc. of free drug in urine at time after administration
Slivko	3	101.0 mg % at 1¾ hr
Greenberg	3	71.5 mg % at 1¾ hr
Parker	2	59.0 mg % at 1¾ hr
Pearl	2	50.5 mg % at 1 hr
Ingalls	4	6.5 mg % at ¾ hr
Ingalls	2½	2.5 mg % at ½ hr

[1] This paper contains material submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at New York University.

[2] Appreciation is expressed for aid from Horace W. Stunkard, and advice from Charles Willey, Harold Fay, Harry Bergman, and Benjamin Slivko.

drug in the urine are obtained much more quickly following administration of sulfaguanidine than following administration, for example, of sulfadiazine. This was demonstrated in 90% of experiments with 40 students—using the method of Marshall, Emerson, and Cutting (*16*) as modified by Bratton and Marshall (*17*) and as described in the Department of the Army Technical Manual TM 8-227, except that smaller total quantities of sample and reagents were employed in a semimicrochemical method.

Excretion of sulfaguanidine by five other persons was further investigated. Free drug levels of sulfaguanidine in urine and percentage yields of the dose over short intervals after administration were determined (Table 1). The rapidity with which the drug appears in the urine was also studied (Table 2).

The amount of drug passed in the urine following administration of a single dose was measured. This varied from a low of 17.3% of the dose recovered as free drug to a high of 84.3% of the dose recovered as total drug (free sulfaguanidine plus acetylsulfaguanidine). In the last instance, a total of 2.53 g from a 3-g dose was excreted; 79% of this was in the free form and 21% acetylated.

The renal clearance for sulfaguanidine was calculated as the volume of blood which would contain the amount of material excreted in one minute. The renal clearance of sulfaguanidine often approached 120 ml/min. This figure indicates some tubular resorption, but less than occurs with urea. Thus the kidney can remove sulfaguanidine from the blood more effectively than it removes urea from the blood. Throughout these studies on renal excretion, blood levels remained at the expected low titers, usually below 1 mg % and never exceeding 2 mg %.

The literature gives ample evidence that sulfaguanidine is effective, especially in intestinal infections, but sulfaguanidine is being replaced to some extent by other drugs now used for intestinal infections. It therefore seems desirable to reevaluate the drug's therapeutic potential. In regard to the therapeutic potential for sulfaguanidine, there is an important piece of pure research in the literature by Clapper and Kurita (*18*). They found that urea and sulfaguanidine at concentrations of 10 mg % each are synergistic against *E. coli*. This is particularly interesting in view of such work as that of Gershenfeld and Sagin (*19*) who found that 220 mg % of sulfaguanidine did not inhibit *E. coli in vitro*.

Since a normal adult passes at least 25 g of urea and rarely passes more than 2500 ml of urine a day, the concentration of urea in urine will almost invariably exceed 1000 mg % or 100 times the concentration needed for a synergistic effect with 10 mg % of sulfaguanidine.

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Manuscript received October 26, 1953.

Communications

Is the Black Widow Spider Invading New England?

During the middle nineteen-thirties a number of biologists were showing considerable interest in the distribution of the black widow spider, *Latrodectus mactans* (Fabricius), and from time to time short notes were published indicating an extension of its known range in the United States, particularly in the North. In early 1937 I showed that records had existed for some of the states for many years (*1*). Later that year the known records indicated that the spider had been collected in every state of the U.S.

This revival of interest occasioned numerous comments in the public press, and the impression received by many laymen was that black widow spiders were spreading northward. It appeared that this idea was particularly prevalent in New England, and at the request of the officials at the New England Museum of Natural History I prepared a short article about the spider for their *Bulletin* (*2*). In this paper were listed all the records then known for New England, which revealed that the black widow had been collected as far back as 1883 for Massachusetts, and 1884 for New Hampshire. It was also shown that although the species is not particularly common in New England, many records exist; and on occasion a large number of specimens has been picked up in a restricted locality.

In 1945 renewed publicity was given the spider after the appearance of a book (*3*) which includes a "Table of Reported Spider Bites by States." In this

table every New England state is listed as having "reports," yet no references are cited. A thorough search of the literature fails to lend support for the listings. As with a good many other statements appearing in the book, the reader is simply misinformed. The "report" for Maine is particularly interesting because as I have shown (*2*), there was not even a record that the black widow had been observed or collected in Maine. What previously had been taken for a valid record was an error, presumably based upon a misidentification. However, I had remarked "the spider undoubtedly occurs there [i.e., in Maine]." It is now possible to report a valid record, for recently I examined a specimen collected at Gorham, Maine, on October 25, 1953, by Frederick Robie. This particular specimen shows no vestige of an hourglass mark, nor does it show the red spot above the anal tubercle, which is present in all other specimens of *L. mactans* I have seen. It is entirely black except for two very small spots in the mid dorsal line on the anterior half of the abdomen.

Again in 1949 further newspaper publicity was given *L. mactans*, shortly after the appearance of a paper in the *New England Journal of Medicine* entitled "Arachnidism," by Greer, a Boston physician (*4*). A careful perusal of the article reveals that less than one page is devoted to an account of six cases seen in a "tropical area." The remainder of the four-page paper is concerned with the symptoms of, and treatment for, black widow spider bite, as well as a rather extensive account of the life history and distribution of *L. mactans* in the U.S. Upon inquiring of the author I was informed that the six cases were those seen while he was stationed in the Philippine Islands, a fact which definitely indicates that another spider was involved, as *L. mactans* does not occur there. There are papers in the literature that describe cases of arachnidism for the Philippines, but these generally appear in journals devoted to tropical medicine. Greer did not cite any of these, but confined his discussion to American spiders. Is it any wonder that, considering the circumstances, newspaper articles based on Greer's article intimated that people in New England had been, and were being, bitten?

Finally, during the past summer the finding of a few black widows in the vicinity of Milford and Bridgeport in Connecticut set off another series of "scare" newspaper articles. Several of the accounts purported to quote an authority to the effect that since this is a rare spider the finding of several would indicate that apparently the black widows must be coming up from the South perhaps in shipments of bananas—this despite the fact that there are records for Connecticut going back to 1912 (*2*) and a large number of more recent ones (*1, 5*). It would seem more reasonable to account for the abundance in some years on the basis of other factors. For example, these could include the variation in the parasite population, and the severity of the preceding winter. Also not to be overlooked is the possibility of more people hunting for specimens when someone else in the neighborhood has his find reported in the newspapers. After one such story, 40 spiders were brought into one laboratory although only two turned out to be black widows. Possibly, all these might have lived and died undisturbed and undiscovered had not the publicity created large numbers of new collectors.

B. J. KASTON

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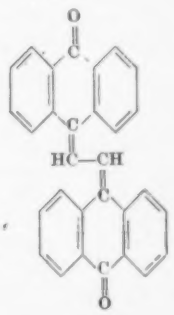
Received December 3, 1953.

Thermochromism and Vinylogy

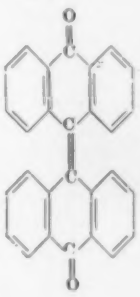
IT seems that the question has not yet been raised whether the vinylene homologs (*1*) (II) of thermochromic ethylene (I)

$$\mathrm{Ar} > \mathrm{C{=}C} < \mathrm{Ar'} \rightarrow \mathrm{Ar} > \mathrm{C{=}CH{-}CH{=}C} < \mathrm{Ar'}$$

(I) (II)



(III)



(IV)

are also thermochromic. We found that 1,2-bis(9,9'-anthronylidene)ethane (*2*) (III), the vinylene homolog of the thermochromic bianthrone (IV), is strongly thermochromic: dilute solutions of (III) in ethyl benzoate are yellow at 0° and orange at the boiling point of the solvent; the phenomenon is reversible. Strong reversible thermochromic effects also were observed with the powdered solid (III) (orange 0° → deep violet at 240°). The importance of these findings for the theory of thermochromism will be discussed in a separate paper.

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Book Reviews

Ascidians of Sagami Bay. Collected by His Majesty the Emperor of Japan. Described and illustrated by Takasi Tokioka; Hirotaro Hattori, Ed. Tokyo: Iwanami Shoten, 1953. 315 pp. 79 plates. 2500 yen.

This is the second of a series of monographs on the fauna of Sagami Bay, edited by Hirotaro Hattori of the Biological Laboratory of the Imperial Household, the first study being of the Opisthobranchia. The present account represents 81 species of Ascidians found in the eastern half of the bay. Of these, 60 are species previously known but imperfectly described, and these together with 21 new species are here given precise and concise descriptions which will be welcomed by acidiologists and marine ecologists everywhere. The text is presented both in Japanese and in English. There are three plates excellently produced in color and 76 full pages of line drawings of superb quality. Altogether, the book is a valuable scientific contribution to marine biology and to systematic ascidian zoology and is beautifully produced. It is to be hoped that His Imperial Majesty the Emperor will continue to encourage marine zoological investigations and that many volumes as good as this will be forthcoming.

N. J. BERRILL

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The Neurophysiological Basis of Mind: The Principles of Neurophysiology. Being the Waynflete Lectures delivered in the College of St. Mary Magdalen, Oxford, in Hilary Term 1952. John Carew Eccles. New York: Oxford Univ. Press, 1953. 314 pp. Illus. $6.50.

Eccles' work is unquestionably the best text available in any language which gives an authoritative description and evaluation of the electrophysiological basis of modern neurophysiology. The first two chapters, dealing with a detailed analysis of the relation between resting and action potentials and ionic changes in the peripheral nerve, are chiefly based on the recent work of the Cambridge school. This is followed by a chapter on the physiology of transmission of impulses across the neuromuscular junction and sympathetic ganglia.

A highly informative discussion is devoted to the changes in potentials of the spinal cord which accompany excitation and inhibition of various reflexes. Furthermore, it is pointed out that prolonged changes in neuronal excitability result from activation and disuse. These results are successfully applied to an interpretation of the mechanisms underlying conditioned reflexes and learning processes in general.

Models of complex neuronal circuits are discussed at length in order to show that the reverberatory activity which exists in the cerebral cortex greatly enhances these "plastic" changes, and to correlate specific mental states such as consciousness, will, and perception with changes in the cortical neuronal network. This latter part appears to the reviewer peculiarly unsatisfactory in an otherwise brilliant work. Recent studies made in this country seem to suggest that a more fruitful approach to the correlation of mental states (consciousness, etc.) with physiological processes can be achieved by the investigation of actual cortical and subcortical events and their mutual relations rather than by ingenious calculations concerning the behavior of schemes of nerve nets.

E. GELLHORN

Department of Physiology
University of Minnesota Medical School

Advances in Carbohydrate Chemistry, Vol. 7. Claude S. Hudson, Melville L. Wolfrom, Sidney M. Cantor, Stanley Peat, and Maurice Stacey, Eds. New York: Academic Press, 1952. 370 pp. $7.50.

This book, the seventh volume of a series indispensable to a chemistry library, continues the periodical review of selected topics in carbohydrate chemistry. Of the eight articles, five have British authors and one a German author. The material presented is essentially for specialists but others will find information of interest particularly in the chapter on The Size and Shape of Some Polysaccharide Molecules. Other topics discussed are The Methyl Ethers of the Aldopentoses and of Rhamnose and Fucose, 1,6-Anhydrohexofuranoses, a New Class of Hexosans, Fructose and Its Derivatives, Psicose, Sorbose and Tagatose, Acetals and Ketals of the Tetritols, Pentitols and Hexitols, The Glycals, and The Chemistry of the 2-Amino Sugars (2-Amino-2-deoxy-Sugars).

In addition to good indexes for this volume, a listing of the tables of contents for each of the first six volumes is included.

RALPH C. CORLEY

Department of Chemistry, Purdue University

New Books

Principles of Transistor Circuits. Richard F. Shea, Ed. New York: Wiley; London: Chapman & Hall, 1953. 535 pp. Illus. $11.00.

Within the Living Plant. An introduction to plant physiology. Erston V. Miller. New York: Blakiston, 1953. 325 pp. Illus. $5.00.

Industrial Inorganic Analysis. Roland S. Young. New York: Wiley, 1953. 368 pp. Illus. $5.75.

Resources and the American Dream. Including a theory of the limit of growth. Samuel H. Ordway, Jr. New York: Ronald Press, 1953. 55 pp. $2.00.

Ultra High Frequency Propagation. Henry R. Reed and Carl M. Russell. New York: Wiley; London: Chapman & Hall, 1953. 502 pp. Illus. $9.50.

A Manual of Australian Soils. C. G. Stephens. Melbourne, Australia: Commonwealth Scientific and Industrial Research Organization, 1953. (Order from: Tait Book Co., 349 Collins St., Melbourne.) 48 pp. + plates. 25s.

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I am among those who think well of the human character generally. I consider man as formed for society, and endowed by nature with those dispositions which fit him for society. I believe also, with Condorcet, as mentioned in your letter, that his [man's] mind is perfectible to a degree of which we cannot as yet form any conception. It is impossible for a man who takes a survey of what is already known, not to see what an immensity in every branch of science yet remains to be discovered, and that too of articles to which our faculties seem adequate.

I join you therefore in branding as cowardly the idea that the human mind is incapable of further advances. This is precisely the doctrine which the present despots of the earth are inculcating, and their friends here re-echoing; and applying especially to religion and politics; that it is not probable that any thing better will be discovered than what was known to our fathers. We are to look backwards then and not forwards for the improvement of science, and to find it amidst fewdal barbarisms and the fires of Spitalfields. But thank heaven the American mind is already too much opened, to list to these impostures; and while the art of printing is left to us, science can never be retrograde; what is once acquired of real knowlege can never be lost. To preserve the freedom of the human mind then and freedom of the press, every spirit should be ready to devote itself to martyrdom; for as long as we may think as we will, and speak as we think, the condition of man will proceed in improvement. The generation which is going off the stage has deserved well of mankind for the struggles it has made, and for having arrested that course of despotism which had overwhelmed the world for thousands and thousands of years. If there seems to be danger that the ground they have gained will be lost again, that danger comes from the generation your contemporary. But that the enthusiasm which characterises youth should lift its parracide hands against freedom and science would be such a monstrous phaenomenon as I cannot place among possible things in this age and this country. Your college at least has shewn itself incapable of it; and if the youth of any other place have seemed to rally under other banners it has been from delusions which they will soon dissipate. I shall be happy to hear from you from time to time, and of your progress in study, and to be useful to you in whatever is in my power; being with sincere esteem Dear Sir Your friend & servt.

TH: JEFFERSON

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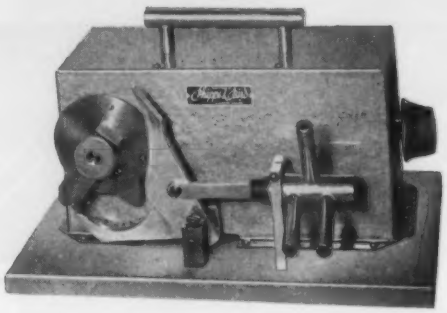

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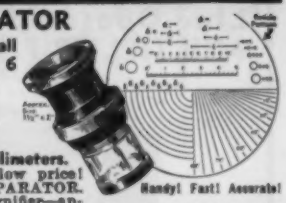

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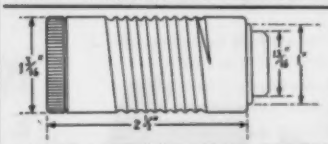

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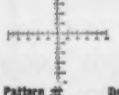

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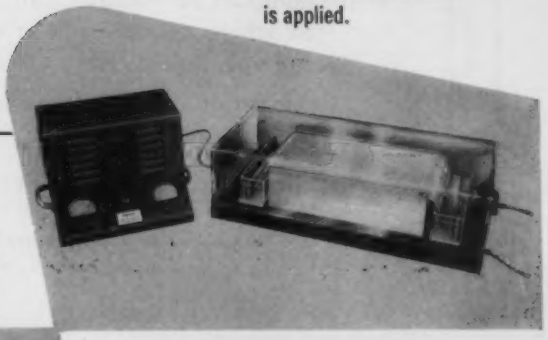

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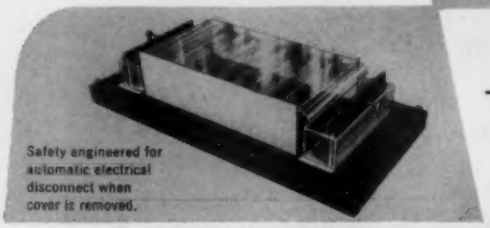

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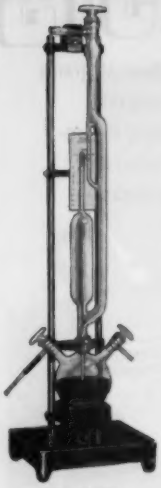

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The papers in this symposium, presented in somewhat abbreviated form at the AAAS Meeting in Philadelphia, will help those wishing to enter this field, especially in the design and construction of equipment. The material—and the bibliography included with the first paper—will also prove invaluable to those actively working in the field. Although the number of contributors is limited, the papers cover developments around the world.

Dr. Linnell, who covers direct current techniques, constructed a photoelectric photometer still in use at the Boyden station in South Africa, and while at Harvard used this in the study of the faint and unusual eclipsing variable, UX Ursae Majoris. His present work involves the development of techniques using subminiature tubes.

Dr. Hall—alternating current techniques—is co-discoverer of the phenomenon of the polarization of the light of certain stars, and was the first astronomer to demonstrate the value of refrigeration of photocells.

Dr. Blitzstein constructed the first pulse-counting photometer for astronomical use and applied it to the observation of eclipsing variables.

Although Dr. Bengt Stromgren of the Yerkes and McDonald Observatories reviewed foreign developments at the Philadelphia meeting, this volume includes papers written by MM. Lellemand and Lenouvel on work at the Observatoire de Haute Provence and by R. O. Redman, Director, and G. G. Yates of the Observatory at Cambridge University.

Dr. Walraven of Leiden describes the work with servomechanisms carried out by him at the Union Observatory in Johannesburg.

Dr. Whitford, who supplies the critical summary and evaluation of future developments, has been considered an outstanding authority in this field for many years. His introduction of the constant deflection method using electrometer tube techniques marked a major advance.

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26–27. American Physical Society, Austin, Tex. (K. K. Darrow, Columbia Univ., New York 27.)

28–4. Pan American Assoc. of Oto-Rhino-Laryngology and Broncho-Esophagology, Mexico City, Mex. (C. L. Jackson, 1901 Walnut St., Philadelphia 3, Pa.)

March

2. Symposium on Problems of Gerontology, The Biltmore, Baltimore, Md. (National Vitamin Foundation, 15 E. 58 St., New York 22, N.Y.)

4–5. American Soc. for Metals, mid-winter, Boston, Mass. (W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.)

6. Symposium on Air Pollution and Its Control, 2nd annual, Staten Island, N. Y. (N. Colosi, Wagner College, Staten Island, N. Y.)

8–9. National Symposium of Division of Organic Chemistry, Chemical Inst. of Canada, Montreal, Canada. (G. E. McCasland, Dept. of Chemistry, Univ. of Toronto, Toronto, Ont.)

8–10. American Inst. of Chemical Engineers, Washington, D.C. (S. L. Tyler, 120 E. 41 St., New York 17.)

8–10. The Wildlife Soc., annual, Chicago, Ill. (G. A. Petrides, Dept. of Fisheries and Wildlife, Michigan State College, East Lansing.)

9–12. American Mosquito Control Assoc., annual, Atlantic City, N.J. (R. E. Dorer, 301 Essex Bldg., Bank & Plume Sts., Norfolk, Va.)

11–13. American Orthopsychiatric Assoc., New York, N. Y. (M. F. Langer, 1790 Broadway, New York 19.)

11–13. Kappa Delta Pi, Lafayette, Ind. (E. I. F. Williams, 277 E. Perry St., Tiffin, Ohio.)

11–13. National Wildlife Federation, annual, Chicago, Ill. (L. F. Wood, 232 Carroll St., NW, Washington 12, D. C.)

15–19. National Assoc. of Corrosion Engineers, annual, Kansas City, Mo. (A. B. Campbell, 1061 M & M Bldg., Houston 2, Tex.)

16–17. Symposium on Monte Carlo Methods, Gainesville, Fla. (H. A. Meyer, Univ. of Florida, Gainesville.)

18. Inst. of Mathematical Statistics, Eastern regional, Gainesville, Fla. (H. A. Meyer, Univ. of Florida, Gainesville.)

18–20. American Physical Soc., Detroit and Ann Arbor, Mich. (K. K. Darrow, Columbia Univ., New York 27.)

20. The Biochemical Soc., annual, London, Eng. (F. L. Warren, Biochemistry Dept., London Hospital Medical College, London W. 1.)

21. International Assoc. for Dental Research, French Lick, Ind. (E. H. Hatton, 311 E. Chicago Ave., Chicago 11, Ill.)

22–24. American Assoc. of Dental Schools, annual, French Lick Springs, Ind. (M. W. McCrea, 42 S. Greene St., Baltimore, Md.)

22–25. Inst. of Radio Engineers, annual, New York City. (E. K. Gannett, 1 E. 79 St., New York.)

24–1. American Chemical Soc., 125th national, Kansas City, Mo. (R. M. Warren, 1155 16 St., NW, Washington, D.C.)

25–27. Optical Soc. of America, spring, New York City. (A. C. Hardy, Massachusetts Institute of Technology, Cambridge 39.)

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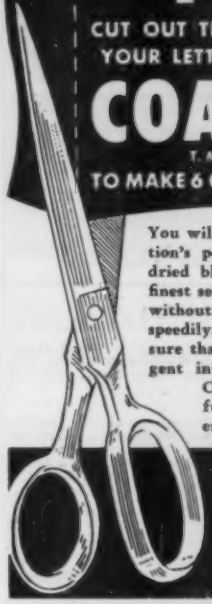

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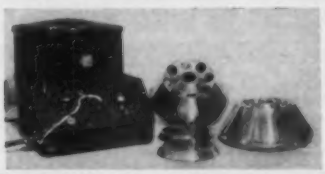

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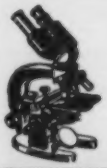

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